REMEDIAL ACTION WORKPLAN/
POST-CLOSURE MONITORING PLAN

AOC-3: Landfarm No. 1
750 Cliff Road, Port Reading
Middlesex County, New Jersey
NJDEP PI# 006148
ISRA Case No. E20130449
EPA ID No. NJD045445483

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Prepared for:

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TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

The Landfarm No. 1 (LF1) is a land treatment system that encompasses approximately 3.9 acres (170,000 square feet) and is constructed of diked walls and a silt and clay liner comprised of fill material and native marsh soils. The LF1 is situated within the Former Hess Corporation – Port Reading Refining (HC-PR) Facility (PI# 006148) which is located at 750 Cliff Road, in Port Reading, Middlesex County, New Jersey, as AOC-3 (the Site).

This Remedial Action Workplan (RAW) / Post-Closure Monitoring Plan (PCMP) prepared by Earth Systems, Inc. (Earth Systems) for the LF1, summarizes the constituents of concern (COCs) for soil and groundwater contamination with the following exceedances:

- The most stringent of the New Jersey Department of Environmental Protection (NJDEP) Residential Direct Contact (RDC) Soil Remediation Standard (SRS) / Default Impact to Groundwater (IGW) Soil Screening Levels (SSL):
    - VOCs: Benzene;
    - SVOCs: Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene, and bis (2-Ethylhexyl) phthalate; and
    - Metals: Arsenic, Beryllium, Cadmium, Chromium, Lead, Mercury, Nickel, Selenium and Vanadium.
- The Groundwater Quality Standards (GWQS):
    - VOCs: Chlorobenzene,
    - SVOCs: bis(2-Ethylhexyl) phthalate, and
    - Metals: Arsenic and Lead.

The RAW / PCMP proposes the following actions to address them:

- <u>VOCs soil exceedances</u> of the NJDEP Default IGW SSLs, by using compliance data analysis:
    - Thiessen Polygon Method averages to evaluate a representative concentration for the LF1;
    - Evaluation of Site-Specific IGW SRS.

- <u>SVOCs and Metals soil exceedances</u> of the RDC SRS and NJDEP Default IGW SSLs through installation of an impermeable cover/cap, designed and maintained to meet the closure performance standards specified at 40 CFR 265.111, to:
    - Minimize the need for future maintenance;
    - Control, minimize or eliminate, to the extent necessary to protect human health and the environment, post-closure escapes of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the groundwater, surface water or to the atmosphere;
        - Comply with the closure requirements of 40 CFR 265.310 (Landfills, Closure and Post-Closure Care);
        - Establish a Deed Restriction for the AOC, and submit a Soil Remedial Action Permit (RAP).

- SVOCs and Metals groundwater exceedances, by applying for a Classification Exception Area (CEA) and Groundwater RAP, for metals, using fate and transport modeling, to determine:
    - Groundwater contamination extent; and
    - Groundwater contamination duration.

Figure 1, a United States Geological Survey (USGS) 7.5-minute series quadrangle map (Arthur Kill, New Jersey), presents the HC-PR facility and associated land features. **Figure 2**, presents the Site Layout with the Landfarms Areas of Concern (AOCs).

2.0 INTRODUCTION

Earth Systems has prepared this RAW/PCMP report to identify the activities required for final closure and post-closure monitoring and maintenance procedures for AOC-3: LF1, at the HC-PR, program interest number 006148, located at 750 Cliff Road, in Port Reading, Middlesex County, New Jersey (the Site).

AOC-3: LF1 is a land treatment system located southeast of the North Landfarm and encompassing approximately 3.9 acres (170,000 square feet). The LF1 was constructed in 1985 with dredged sediments from the Arthur Kill. The LF1 has a surface elevation of about 10 feet above mean sea level (amsl), and is completely surrounded by dike walls, which prevent surface water runoff. Stormwater outside the boundaries of the landfarm either percolates into the ground or sheet flows to the north ditch.

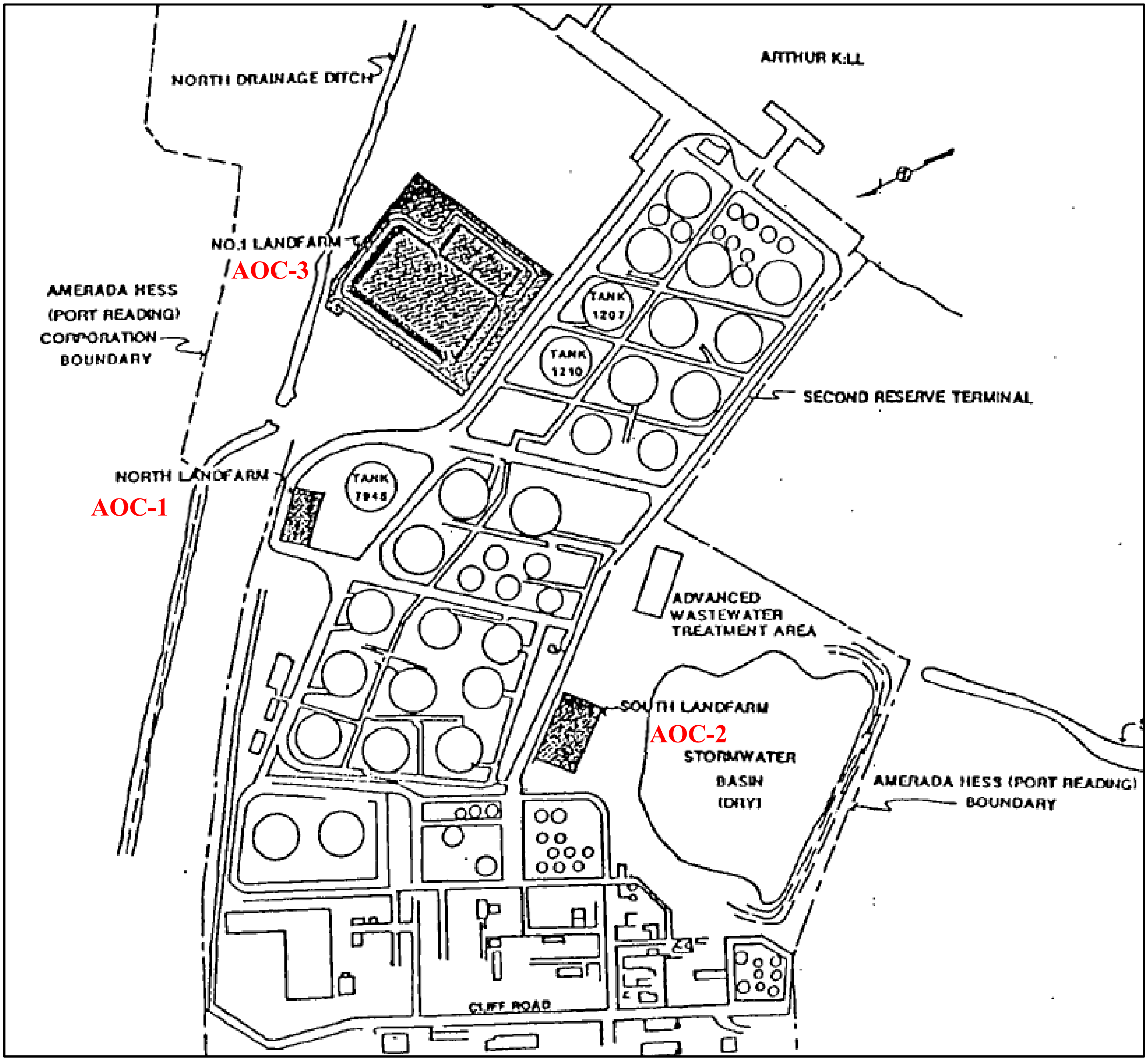


Figure 1, a USGS 7.5-minute series quadrangle map (Arthur Kill, New Jersey), presents the HC-PR facility and associated land features. **Figure 2**, presents the Site Layout, along with the Landfarms AOCs. **Figure 3a** and **Figure 3b** present the location of the AOC-3: LF1 and the monitoring wells associated with the AOC-3: LF1.

The landfarm began operation in 1985, and was part of the waste management system for the tank farm operations, receiving Refinery / Terminal waste products such as oily soil and oily sludge from the on-site API Separator (hazardous waste code K051), heat exchanger bundle cleaning, recoverable oil tank bottoms, leaded tank bottoms (hazardous waste code K052) and Tetraethyllead (TEL) bottoms.

No Closure Plan has been submitted to USEPA / NJDEP for the LF1, only requests for extensions for the closure.

The US EPA Region II requested in a July 1, 1995 correspondence letter that HC-PR submit an updated summary of all investigations and remediation activities conducted at the Site. On November 14, 1995, HC-PR was informed through NJDEP correspondence that the Bureau of Federal Case Management (BFCM) would assume oversight of the LF1, in addition to other applicable areas of concern.

Soil sampling was performed for the LF1 annually; in July 2000, July 2001, July 2002, July 2003, December 2004, August 2005, August 2006, December 2007, November 2008, July 2009, July 2011 and July 2012. Sampling results indicated that concentrations of organic and inorganic parameters were above the closure criteria specified by NJDEP at that time (former Closure Plan Target Levels). Based on these results, it was determined that “clean closure” could not be achieved for the LF1. Although it was determined that clean closure wasn't possible in 2012, soil sampling continued to be conducted annually in accordance with the permit.

The LF1 has been the subject of environmental investigation and monitoring for approximately 30 years, from 1985 (**Appendix 1**) to the present, as part of previous closure activities. Four (4) permitted monitoring wells, designated L1-1 through L1-4, were installed along the eastern, northern and western perimeter of the LF1. These wells, along with two (2) background wells (BG-2 and BG-3) are sampled on a quarterly basis in accordance with the NJPDES permit. Quarterly sampling of L1-1 through L1-4 and BG-2 and BG-3 includes VOCs, SVOCs, metals and general chemistry. Quarterly ground water monitoring will continue at LF1 until closure is completed.

The results of the quarterly sampling are reported to the NJDEP on a semiannual basis, with the latest report dated July 25, 2016.

The LF1 is currently in Interim Status and will be closed pursuant to the requirements for RCRA landfills specified in 40 CFR 265.310 (Landfills). The materials will be managed as Hazardous Materials, meeting the RCRA treatment requirements and land disposal restrictions of 40 CFR 268 – Land Ban Restrictions.

The RAW/PCMP included herein presents the final closure actions, and the proposed post-closure monitoring plan, to address the following COCs exceeding the applicable NJDEP standards:

- The most stringent of the NJDEP RDC SRS / Default IGW SSL:
  - VOCs: Benzene;
  - SVOCs: Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene, and bis (2-Ethylhexyl phthalate); and
  - Metals: Arsenic, Beryllium, Cadmium, Chromium, Lead, Mercury, Nickel, Selenium and Vanadium.

- The GWQS:
  - VOCs: Chlorobenzene,
  - SVOCs: bis(2-Ethylhexyl) phthalate, and
  - Metals: Arsenic and Lead.

The RAW/PCMP for the existing soil and groundwater contamination at the Site was performed to satisfy all NJDEP requirements in accordance with New Jersey Administrative Code (N.J.A.C.) 7:26E, *The Technical Requirements for Site Remediation (TRSR)*; N.J.A.C 7:26C, *The Administrative Requirements for the Remediation of Contaminated Sites (ARRCS)*; N.J.S.A. 58:10C-1 et seq., *The Site Remediation Reform Act (SRRA)*; and the associated NJDEP SRRA Guidance Documents. RCRA closure and post-closure requirements, as specified in *40 CFR 265*, were also incorporated into this RAW/PCMP, as applicable.

Based upon the 2001 through 2016 soil investigation data and 2005 through 2016 groundwater investigation data, this RAW/PCMP proposes the following actions to address:

<u>Soils</u>

- <u>VOCs soil exceedances</u> of the NJDEP Default IGW SSLs, by using compliance data analysis:
  - Thiessen Polygon Method averages to evaluate a representative concentration for the LF1;
  - Evaluation of Site-Specific IGW SRS.
- <u>SVOCs and Metals soil exceedances</u> of the RDC SRS and NJDEP Default IGW SSLs through installation of an impermeable cover/cap, designed and maintained to meet the closure performance standards specified at 40 CFR 265.111, to:
  - Minimize the need for future maintenance;
  - Control, minimize or eliminate, to the extent necessary to protect human health and the environment, post-closure escapes of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the groundwater, surface water or to the atmosphere;
  - Complies with the closure requirements of 40 CFR 265.310 (Landfills, Closure and Post-Closure Care);
  - Establish a Deed Restriction for the AOC, and submission of a Soil Remedial Action Permit.

Groundwater

- SVOCs and Metals groundwater exceedances, by applying for a CEA and Groundwater RAP, for metals, using fate and transport modeling, to determine:
    - Groundwater contamination extent; and
    - Groundwater contamination duration.

Subsequent to the submittal and approval of the RAW/PCMP, completion of the impermeable cap, receipt of approved Soils and Groundwater RAPs, a Conditional Response Action Outcome (RAO) will be issued under separate cover by the Site's LSRP of record for the Site's AOC-3: LF1.

3.0 BACKGROUND

3.1 Site Description

The HC-PR facility is an approximate 210-acre irregularly shaped parcel, situated in an industrially developed waterfront area. A Site location map for the HC-PR facility is presented as **Figure 1**. The HC-PR facility is identified as Block 756, Lot 3; Block 756B, Lot 1; Block 751, Lot 1; Block 760, Lot 6; and Block 760B, Lots 1 and 3, as shown on the tax map.

The HC-PR facility is located east of Cliff Road and abuts the southern property boundary of the Conrail Port Reading Rail yard. Immediately east-southeast of the facility is the Arthur Kill Shipping Channel, and to the southwest is the PSE&G Sewaren Generating facility. The former Port Reading Coal Docks, currently owned by Prologis Corporation, are located to the northeast. Port Reading Avenue is located to the northwest. A mixture of industrial and commercial properties are located to the west. Two (2) residential properties are located up-gradient to the northwest, and an industrial property is located to the south.

The HC-PR facility formerly processed low sulfur gas oils and residuals as feed to a Fluidized Catalytic Cracking Unit (FCCU) that converted gas oil into gasoline, fuel oil, and other hydrocarbon products (e.g. methane, ethane and liquid petroleum gas). The HC-PR site operations were initiated in 1958 with a Crude Topping Unit and underwent various expansions between 1958 and 1970. In 1974, refining operations were suspended and the facility operated only as a bulk storage and distribution terminal until 1985. In April 1985, following a retrofit, the HC-PR facility resumed refining operations. Demolition of the refinery was completed in 2015. Currently the Site is operated only as a bulk storage and distribution terminal.

The refinery utilized on-site land treatment (landfarming) to effectively treat and dispose of waste. The landfarms utilize the natural soil matrices as a substrate to biologically treat organics and to immobilize metals. The landfarms have received two (2) listed hazardous waste streams, namely API Separator Sludge (K051) and Leaded Tank Bottoms (K052).

AOC-3: LF1 is a land treatment system which encompasses approximately 3.9 acres. The LF1 was constructed in 1985 with dredged sediments from the Arthur Kill. The LF1 has a surface elevation of about 10 feet amsl and is completely surrounded by dike walls, which prevent surface water runoff. Stormwater outside the boundaries of the landfarm either percolates into the ground or sheet flows to the north ditch. **Figures 3a and 3b** present the location of the AOC-3: LF1 and the monitoring wells associated with the AOC-3: LF1.

The landfarm began operations in 1985, and was part of the waste management system for the tank farm operations, receiving Refinery / Terminal waste products such as oily soil and oily sludge from the on-site API Separator (hazardous waste code K051), heat exchanger bundle cleaning, recoverable oil tank bottoms, leaded tank bottoms (hazardous waste code K052) and TEL gasoline sludge.

No Closure Plan has been submitted to USEPA / NJDEP for LF1, only requests for extensions for closure.

The No. 1 Landfarm is designed as a ‘state of the art’ land treatment unit with a clay liner and leachate collection system. Historically, leachate from the No. 1 Landfarm was directed to the onsite treatment facility which was closed in 2015. In anticipation of this, Hess applied for and obtained a NJPDES Master General Permit (No. NJ0102709) and NJPDES Discharge to Surface Water (DSW) B4B Permit (No. NJG0225720) with a Treatment Works Approval (TWA) (No. 14-0306) for the treatment and discharge of leachate water to the adjacent North Drainage Ditch. Installation of the treatment system was completed and discharge to the North Drainage Ditch began in October 2014. The treatment facility was shut down during the First Quarter 2015. The results indicated the nickel and Total Organic Carbon (TOC) concentrations of 348 micrograms per liter (µg/l) and 36.1 mg/l exceeded permit allowances. The nickel permit allowance is a daily maximum of 100 µg /l and monthly average of 50 µg /l. The TOC permit allowance is a daily maximum of 20 µg /l and there is no monthly average specified. Hess has upgraded the system to effectively treat the nickel and TOC exceedances.

The RAW/PCMP, included herein, presents the COCs detections and exceedances, in soil and groundwater, along with the closure measures to address them via the RAW and monitor the performance of those measures via the PCMP.

3.2 Site Topography

The local topography of the refinery is relatively flat, with a very gradual slope downward to the Arthur Kill.

The topographic relief on the developed portion of the site is about 5 feet, as observed from the topographic survey results indicating that the developed portion of the property, which has an approximate total area of 210 acres, ranges in elevation from about 5 to 10 feet amsl.

The ground surface elevation within the LF1 ranges from 10 to 13 feet amsl, as defined by National Geodetic Vertical Datum of 1929. The LF1 is surrounded by an earthen dike system, placing the dike elevation at approximately 14 to 17 feet amsl. The 100-year flood level at the HC-PR facility is 10 feet amsl.

3.3 Site Geology and Hydrogeology

The geology of the facility was determined from the data collected at the HC-PR facility, during the subsurface investigations, and from the Geologic Map of the State of New Jersey. The HC-PR facility is underlain by the Magothy and Raritan formations. The Magothy Formation consists of dark lignitic sand and clay containing some glauconite near the top, and the overlying Raritan Formation consists of variable sands and clays. The western section of the HC-PR facility is underlain by a thick clay unit, while marsh deposits underlie the eastern and southeastern section of the HC-PR facility.

Soil borings and monitoring well locations are shown on **Figure 4**. Well construction details are presented in **Table 1**. Well logs are included in **Appendix 2**.

Based on the soil boring logs and monitoring well logs prepared for the Site, and included as **Appendix 2**, the LF1 is underlain by approximately eight (8) feet of dredge fill that consists of reddish-brown sands with clay and silt. Underlying this fill layer is a marsh deposit consisting of an organic rich clayey silt unit that changes to an organic rich fibrous material (peat) zone with silty clay at approximately ten (10) feet bgs. The marsh deposit is underlain by a sand zone and clay layer. A generalized stratigraphic cross-section for the area is enclosed as **Figure 5**.

The shallow unconfined water table at the HC-PR facility was encountered between approximately 3 and 8 feet bgs, as shown in **Table 1**, with groundwater elevation data. Site-wide groundwater elevation contours from November 11, 2013 are presented as **Figure 6a**, and LF1 groundwater elevation contours from April 21, 2015 are presented as **Figure 6b**.

Groundwater flow is predominately to the north-northeast in the northeastern portion of the HC-PR facility. The HC-PR facility wells located adjacent the Arthur Kill and North Drainage Ditch are subject to tidal influences. Wells located further away from the Arthur Kill are generally not subject to tidal influence. An average hydraulic gradient of approximately 0.001 feet /per feet was calculated for the Site.

The upper unconfined aquifer is separated from the deep aquifer by the relatively impermeable marsh deposit.

The NJDEP requested that HC-PR provide lines of evidence that the marsh deposit, located between the water table aquifer and the confined aquifer beneath the marsh layer, is an effective aquiclude. The two wells, BG-1 and BG-2, at the LF1, on the north side of the refinery, showed different water levels, indicating that the two aquifers are hydraulically separate. The LF1 is located over an area where the marsh deposits are six (6) feet or greater, therefore it was concluded that leachate from the LF1 would not affect the confined aquifer beneath the marsh layer.

Groundwater above the silty clay is considered to be an unconfined water table aquifer and is separated from the deeper aquifer by relatively impermeable marsh deposits.

Currently, four (4) permitted monitoring wells, designated L1-1 through L1-4 and two (2) background wells, designated as BG-2 and BG-3, are specifically associated with the LF1.

Surface water (precipitation) at the LF1 is contained by the dike walls.

4.0 SITE REMEDIAL INVESTIGATION

Several soil and groundwater investigations were conducted between 1980 and 2016 at the LF1 as part of previously approved closure activities.

Based on these investigations, the following COCs with concentrations exceeding the NJDEP RDC SRS and the GWQS are present: VOCs and Metals.

4.1 Soil Investigation

Investigations of the soils were conducted annually at LF1, from July 2000 to July 2016, as shown in **Tables 2a** through **2h,** with the collection of VOC, SVOC, metals, and general chemistry data. The historical sampling analytical results indicated that concentrations of hazardous constituents in LF1 soils were above the applicable soil remediation standards, as summarized below:

VOCs:

- Benzene concentrations detected at the TZ location ranged from 0.0012 milligrams per kilogram (mg/kg; 8/30/2006) to 0.156 mg/kg (7/11/2001), below the NJDEP NRDC SRS of 5 mg/kg and RDC SRS of 2 mg/kg, but above the NJDEP Default IGW SSL of 0.005 mg/kg.

The recent ten (10) years of data, from 2006 through 2016, showed no VOCs concentrations to be detected above the NJDEP NRDC or RDC SRS.

SVOCs:

- Benzo(a)anthracene concentrations detected at the Z0I, TZ and UZ locations ranged from 0.0519 mg/kg (8/10/2005) to 133 mg/kg (7/12/2000), above the NJDEP NRDC SRS of 2 mg/kg and RDC SRS of 0.6 mg/kg, and above the NJDEP Default IGW SSL of 0.08 mg/kg;
- Benzo(a)pyrene concentrations detected at the Z0I, TZ and UZ locations ranged from 0.0616 mg/kg (12/3/2004) to 89.8 mg/kg (7/12/2000), above the NJDEP NRDC SRS, RDC SRS and NJDEP Default IGW SSL of 0.2 mg/kg;
- Benzo(b)fluoranthene concentrations detected at the Z0I, TZ and UZ locations ranged from 0.016 mg/kg (7/26/2012) to 154 mg/kg (7/12/2000), above the NJDEP NRDC SRS of 2 mg/kg and RDC SRS of 0.6 mg/kg, and above the NJDEP Default IGW SSL of 2 mg/kg;
- Benzo(k)fluoranthene concentrations detected at the Z0I, TZ and UZ locations ranged from 0.035 mg/kg (12/3/2004) to 116 mg/kg (7/12/2000), above the NJDEP NRDC SRS of 23 mg/kg and RDC SRS of 6 mg/kg, and above the NJDEP Default IGW SSL of 25 mg/kg;
- Chrysene concentrations detected at the Z0I, TZ and UZ locations ranged from 0.0798 mg/kg (7/18/2002) to 269 mg/kg (7/12/2000), above the NJDEP NRDC SRS of 230 mg/kg and RDC SRS of 62 mg/kg, and above the NJDEP Default IGW SSL of 80 mg/kg;
- Dibenzo(a,h)anthracene concentrations detected at the Z0I, TZ and UZ locations ranged from 0.0775 mg/kg (7/26/2012) to 1.8 mg/kg (7/21/2016), above the NJDEP NRDC SRS and RDC SRS of 0.2 mg/kg and above the NJDEP Default IGW SSL of 0.8 mg/kg;

- Bis (2-Ethylhexyl phthalate) concentrations detected at the Z0I, TZ and UZ locations ranged from 0.0859 mg/kg (7/26/2012) to 65.7 mg/kg (7/12/2000), below the NJDEP NRDC SRS of 140 mg/kg, and the NJDEP Default IGW SSL of 1,200 mg/kg, but above the RDC SRS of 35 mg/kg.

The most recent soil sampling was performed on July 21, 2016 (**Table 2h**). The soil samples were collected from three (3) depth intervals: 0.5 to 1.0 foot bgs, 1.5 to 3 feet bgs and 3.0 to 4.0 feet bgs. The following is a summary of the 2016 exceedances for SVOC constituents:

- Benzo(a)anthracene was detected at the TZ location at a concentration of 1.5 mg/kg and the UZ location at a concentration of 3.7 mg/kg, above the NJDEP NRDC SRS of 2 mg/kg and RDC SRS of 0.6 mg/kg, and above the NJDEP Default IGW SSL of 0.08 mg/kg;
- Benzo(a)pyrene was detected at the TZ location at a concentration of 1.8 mg/kg and the UZ location at a concentration of 3.1 mg/kg, above the NJDEP NRDC SRS, RDC SRS and NJDEP Default IGW SSL of 0.2 mg/kg;
- Benzo(b)fluoranthene was detected at the TZ location at a concentration of 1.6 mg/kg and the UZ location at a concentration of 2.7 mg/kg, above the NJDEP NRDC SRS of 2 mg/kg and RDC SRS of 0.6 mg/kg, and above the NJDEP Default IGW SSL of 2 mg/kg;
- Dibenzo(a,h)anthracene concentrations detected at the Z0I, TZ and UZ locations ranged from 0.92 mg/kg to 1.8 mg/kg, above the NJDEP NRDC SRS and RDC SRS of 0.2 mg/kg and above the NJDEP Default IGW SSL of 0.8 mg/kg;
- Indeno(1,2,3-cd)pyrene concentrations detected at the Z0I, TZ and UZ locations ranged from 1.2 mg/kg to 2.3 mg/kg, above the NJDEP NRDC SRS of 2 mg/kg and RDC SRS of 0.6 mg/kg and below the NJDEP Default IGW SSL of 7 mg/kg.

<u>Metals</u>:

- Arsenic concentrations detected at the Z0I, TZ and UZ locations ranged from 3.1 mg/kg (7/11/2001) to 53 mg/kg (7/29/2009), above the NJDEP NRDC SRS, RDC SRS and NJDEP Default IGW SSL of 19 mg/kg;
- Beryllium concentrations detected at the Z0I, TZ and UZ locations ranged from 0.36 mg/kg (7/22/2011) to 1 mg/kg (7/21/2016), below the NJDEP NRDC SRS of 140 mg/kg and RDC SRS of 16 mg/kg, but above the NJDEP Default IGW SSL of 0.5 mg/kg;
- Cadmium concentrations detected at the Z0I, TZ and UZ locations ranged from 0.66 mg/kg (7/26/2012) to 2.3 mg/kg (7/26/2012), below the NJDEP NRDC SRS and RDC SRS of 78 mg/kg, but above the NJDEP Default IGW SSL of 1 mg/kg;
- Chromium concentrations detected at the Z0I, TZ and UZ locations ranged from 5.1 mg/kg (8/30/2006) to 115 mg/kg (7/11/2001), above the NJDEP Screening Level for Hexavalent Chromium of 20 mg/kg[i] and above the US EPA Chromium Hexavalent (Cr+6) Residential Soil Screening Level (SSL) of 0.3 mg/kg and Non-Residential SSL of 6.3 mg/kg, but below the Chromium Trivalent (Cr+3)

[i] http://www.nj.gov/dep/srp/guidance/rs/chrome_criteria.pdf

Residential SSL of 120,000 mg/kg and Non-Residential SSL of 1,800,000 mg/kg[ii];

- Lead concentrations detected at the Z0I, TZ and UZ locations ranged from 7.4 mg/kg (7/22/2011) to 202 mg/kg (12/18/2007), below the NJDEP RDC SRS of 400 mg/kg, below the NRDC SRS of 800 mg/kg and above the NJDEP Default IGW SSL of 90 mg/kg;
- Mercury concentrations detected at the Z0I, TZ and UZ locations ranged from 0.035 mg/kg (7/22/2011) to 2.5 mg/kg (7/29/2009), below the NJDEP NRDC SRS of 65 mg/kg and RDC SRS of 23 mg/kg, but above the NJDEP Default IGW SSL of 0.1 mg/kg;
- Nickel concentrations detected at the Z0I, TZ and UZ locations ranged from 8 mg/kg (7/18/2002) to 1,280 mg/kg (7/29/2009), below the NJDEP NRDC SRS of 23,000 mg/kg and RDC SRS of 1,600 mg/kg but above the NJDEP Default IGW SSL of 48 mg/kg;
- Selenium concentrations detected at the Z0I, TZ and UZ locations ranged from 1.2 mg/kg (7/11/2001) to 23.4 mg/kg (7/29/2009), below the NJDEP NRDC SRS of 5,700 mg/kg, RDC SRS of 390 mg/kg, but above the NJDEP Default IGW SSL of 11 mg/kg.
- Vanadium concentrations detected at the Z0I, TZ and UZ locations ranged from 11.2 mg/kg (7/18/2002) to 110 mg/kg (7/23/2003), below the NJDEP NRDC SRS of 1,100 mg/kg, but above the RDC SRS of 78 mg/kg.

The most recent soil sampling was performed on July 21, 2016 (**Table 2h**). The soil samples were collected from three (3) depth intervals: 0.5 to 1.0 foot bgs, 1.5 to 3 feet bgs and 3.0 to 4.0 feet bgs. The following is a summary of the 2016 exceedances for Metals constituents:

- Arsenic was detected in the ZOI location at a concentration of 48 mg/kg and the TZ location at a concentration of 35 mg/kg, above the NJDEP NRDC SRS, RDC SRS and NJDEP Default IGW SSL of 19 mg/kg;
- Beryllium was detected in the TZ location at a concentrations of 1 mg/kg, below the NJDEP NRDC SRS, RDC SRS, but above the NJDEP Default IGW SSL of 0.5 mg/kg;
- Chromium concentrations detected at the Z0I, TZ and UZ locations ranged from 58 mg/kg to 87 mg/kg, above the NJDEP Screening Level for Hexavalent Chromium of 20 mg/kg[iii] and above the US EPA Chromium Hexavalent (Cr+6) Residential Soil Screening Level (SSL) of 0.3 mg/kg and Non-Residential SSL of 6.3 mg/kg, but below the Chromium Trivalent (Cr+3) Residential SSL of 120,000 mg/kg and Non-Residential SSL of 1,800,000 mg/kg[iv];
- Mercury concentrations detected at the Z0I, TZ and UZ locations ranged from 0.83 mg/kg to 2.2 mg/kg, below the NJDEP NRDC SRS, RDC SRS, but above the NJDEP Default IGW SSL of 0.1 mg/kg;

[ii] http://www2.epa.gov/risk/risk-based-screening-table-generic-tables
[iii] http://www.nj.gov/dep/srp/guidance/rs/chrome_criteria.pdf
[iv] http://www2.epa.gov/risk/risk-based-screening-table-generic-tables

- Nickel concentrations detected at the Z0I, TZ and UZ locations ranged from 380 mg/kg to 1200 mg/kg, below the NJDEP NRDC SRS of 23,000 mg/kg and RDC SRS of 1,600 mg/kg but above the NJDEP Default IGW SSL of 48 mg/kg.

4.2 Groundwater Investigation

HC-PR's New Jersey Pollution Discharge Elimination System (NJPDES) Discharge to Groundwater (DGW) permit specified groundwater monitoring for five (5) groundwater monitoring wells at LF1. Six (6) wells L1-1 through L1-4, BG-1 and BG-2 are currently monitored. Well BG-1 was added to the monitoring program on July 2012. Groundwater from monitoring wells is analyzed for VOCs (**Table 3a**), SVOCs (**Table 3b**), metals (**Table 3c**) and general chemistry parameters (**Table 3d**). The monitoring results have been reported to NJDEP on a quarterly basis since January 21, 2005. Groundwater monitoring results from 2015 and 2016 are summarized on **Tables 3e** and **3f**.

<u>Volatile Organic Compounds (VOCs)</u>

Chlorobenzene was the only VOC detected in groundwater at a concentration of 65.7 micrograms per Liter (ug/L), slightly above the NJDEP GWQS of 50 ug/L, in only one well (L1-2) and during only one sampling event, October 21, 2011.

<u>Semi-Volatile Organic Compounds (SVOCs)</u>

Bis (2-Ethylhexyl) phthalate was the only SVOC detected historically in groundwater at concentrations above the NJDEP GWQS of 3 ug/L. The maximum Bis (2-Ethylhexyl) phthalate concentrations in each of the wells was 15.8 ug/L in well L1-1 (1/11/2008), 3.1 ug/L in well L1-2 (7/22/2008), 16.6 ug/L in well L1-3 (10/23/2006), 14.2 ug/L in well L1-4 (1/19/2012), 6.2 ug/L in well BG-2 (1/15/2014) and 1.7 ug/L in well BG-3 (10/15/2014).

Benzo(a)anthracene, Benzo(a)pyrene, and Benzo(b) fluoranthene were also detected once (10/15/2014) in one well, (L1-2), at concentrations of 0.77 ug/L, 1.3 mg/L and 0.94 ug/L, respectively, slightly above the NJDEP GWQS of 0.1 ug/L, 0.1 ug/L and 0.2 ug/L. These constituents are known to be associated with historic fill at the Site. Since these contaminants were only detected during one round of sampling, they will not be considered COCs that require remediation.

No SVOCs were detected in excess of the NJDEP GWQS during the last two rounds of groundwater sampling (1/15/2016 and 4/26/2016).

<u>Metals</u>

Antimony, arsenic and lead were detected in groundwater samples from the LF1 wells:

- The maximum antimony concentration of 9.5 ug/L (10/15/2014), which is above the GWQS of 6 ug/L, was detected in the groundwater sample collected from L1-4.
- The maximum detected arsenic concentration was observed in the groundwater sample collected from BG-3, at a concentration of 215 ug/L (7/25/2012), which is above the GWQS of 3 ug/L.
- The maximum lead concentration of 107 ug/L (10/15/2014), which is above the GWQS of 5 ug/L, was detected in the groundwater sample collected from well L1-4.

General Chemistry

The groundwater samples collected from the LF1 wells were analyzed for Cyanide, Nitrogen, Ammonia, Phenols and pH. Nitrogen, Ammonia had maximum concentration of 7.1 mg/L, in BG-2 (10/23/2012), which exceeded the GWQS of 3 mg/L. pH ranged from 5.23 in BG-2 (1/19/2012) to 7.34 in BG-3 (10/23/2012), with the minimum pH outside the pH range of 6.5 to 8.5.

4.3 Leachate Investigation

The LF1 leachate data was collected quarterly at the L1 location, 2005 to 2016 as summarized in **Tables 4a** through **4c**, and analyzed for:

- VOCs: Benzene, Chlorobenzene, Ethylbenzene, Toluene, Total Xylenes, Methyl Tert Butyl Ether (MTBE) and Tert Butyl Alcohol (TBA);
- SVOCs: Anthracene, Benzenethiol, bis(2-ethylhexyl) phthalate, Dimethyl Phthalate, Di-n-Butyl Phthalate, Phenanthrene, Pyrene, and Pyridine;
- Metals: Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Lead, Mercury, Nickel, Selenium and Vanadium.

The only constituents exceeding the NJDEP GWQS were:

- Arsenic – maximum concentration of 10.5 ug/L (10/9/2013) which exceeds the NJDEP GWQS of 3 ug/L,
- Nickel - maximum concentration of 528 ug/L (10/29/2014) which exceeds the NJDEP GWQS of 100 ug/L, and
- Selenium – maximum concentration of 866 ug/L (4/20/2011) which exceeds the NJDEP GWQS of 40 ug/L.

4.4 Lysimeter Investigation

The LF1 lysimeter data was collected quarterly at the LY1 and LY2 locations, from 2005 to 2016, as summarized in **Tables 5a** through **5c**, and analyzed for:

- VOCs: Benzene, Carbon Disulfide, Chlorobenzene, Ethylbenzene, Toluene, Total Xylenes, MTBE and TBA;
- SVOCs: Phenol, bis(2-ethylhexyl) phthalate, Dimethyl Phthalate, 3&4-Methylphenol;
- General Chemistry: Ammonia, pH and Sulfide Reactivity;
- Metals: Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Lead, Mercury, Nickel, Selenium and Vanadium.

The only constituents exceeding the NJDEP GWQS were Arsenic, Lead, and Nickel, with maximum concentrations of 56.5 ug/L on 7/20/2011 (above NJDEP GWQS of 3 ug/L), 379 ug/L on 7/25/2012 (above the NJDEP GWQS of 5 ug/L), and 237 ug/L on 7/25/2012 (above the NJDEP GWQS of 100 ug/L), respectively. LY2 was not sampled in 2015 and 2016 since the lysimeter was dry.

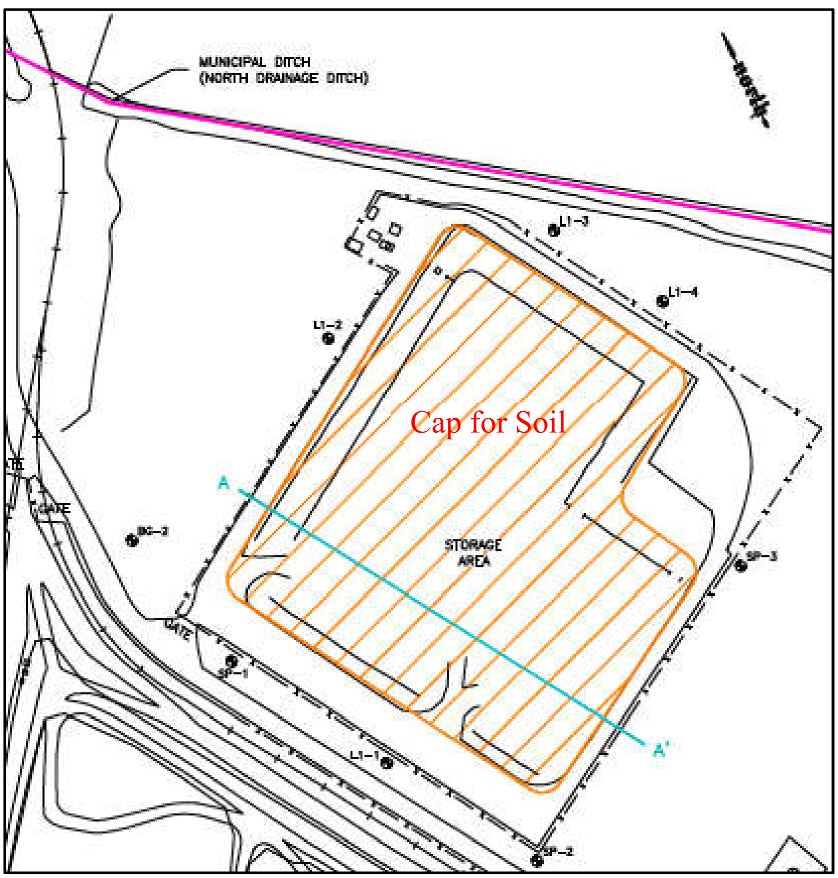
The pH minimum was 3.96, in a sample from LY2 on 7/25/2012 which is outside the 6.5-8.5 required pH range.

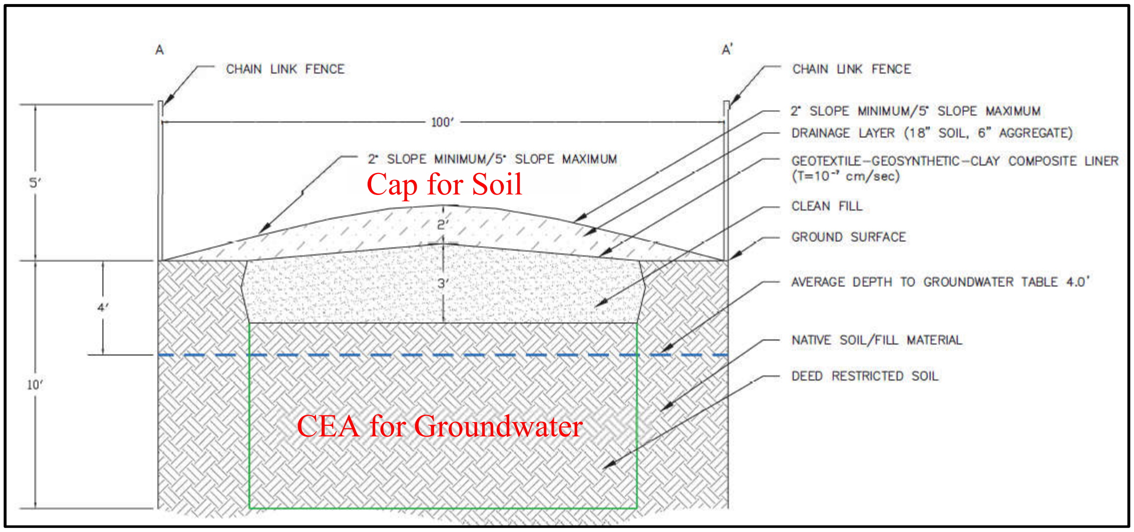
5.0 CONCEPTUAL SITE MODEL

This section summarizes the Conceptual Site Model (CSM) for the LF1 that was developed as part of the RAW. This information has been updated as appropriate, based on recent findings obtained through continued environmental monitoring. The CSM describes the nature and extent of possible soil, groundwater and surface water impacts that have been identified during the soil investigation and surface and groundwater monitoring, the potential human health and ecological receptors, summarizing the risk evaluations that were performed, while outlining the regulatory requirements governing the landfarm. Together, these factors are expected to provide the basis for remedial actions at the landfarm.

Soils at the Site are impacted with SVOCs and metals (i.e., lead), with discrete concentrations slightly above the applicable soil remediation standards, while groundwater is impacted only with metals.

To address the direct contact pathway for potential human health and ecological receptors, a cap is proposed as the remedial action. The groundwater ingestion pathway will be addressed via a CEA. A human health and ecological risk assessment will be conducted as part of the Sitewide Remedial Investigation, if necessary.




A
A'
CHAIN LINK FENCE
CHAIN LINK FENCE
100'
5'
4'
10'
2' SLOPE MINIMUM/5' SLOPE MAXIMUM
Cap for Soil
2'
3'
2" SLOPE MINIMUM/5" SLOPE MAXIMUM
DRAINAGE LAYER (18" SOIL, 6" AGGREGATE)
GEOTEXTILE–GEOSYNTHETIC–CLAY COMPOSITE LINER
(T=10⁻⁷ cm/sec)
CLEAN FILL
GROUND SURFACE
AVERAGE DEPTH TO GROUNDWATER TABLE 4.0'
NATIVE SOIL/FILL MATERIAL
DEED RESTRICTED SOIL
CEA for Groundwater

6.0 REMEDIAL ACTION WORKPLAN / POST-CLOSURE MONITORING PLAN

Based on the SI activities, the RAW/PCMP proposes the following actions to be performed at LF1:

- Evaluation of VOCs residual soil contamination to address the IGW pathway, which cannot be addressed by an engineering cap, using:
  - NJDEP Attainment Guidance and / or
  - IGW Guidance;
- A Cap with a Deed RAP for soils, to address SVOC and metals exceedances of the applicable standards;
- A CEA and a RAP for groundwater to address the SVOC and metals exceedances of the NJDEP GWQS.

The PCMP, included herein as part of the RAP, addresses the parameters and the frequency of monitoring groundwater to confirm no off-site migration.

6.1 Evaluation of VOCs Residual Soil Contamination

In order to address the RDC and/or the IGW pathway for soils at LF1, the following protocol will be followed in accordance with NJDEP guidelines:

- Develop the COCs list with those chemicals in the vadose zone above the groundwater table, that exceed the NJDEP RDC SRS / Default IGW SSLs;

- Use the NJDEP Technical Guidance for the Attainment of Remediation Standards and Site-Specific Criteria Thiessen Polygon Method to develop the AOC soil representative concentrations;

- Screen the AOCs representative soil concentrations versus the NJDEP RDC SRS / Default IGW SSLs;

- Determine if groundwater is impacted with the COCs;

- Select the vadose zone and the groundwater fate and transport models to determine Site-specific IGW SRS, for the cases in which the AOCs soil representative concentrations is above the NJDEP Default IGW SSLs;

- Analyze the Site-specific data to determine the fate and transport model(s) input parameters and run the fate and transport model(s) to derive Site-specific IGW SRS; and

- Screen the AOC representative soil concentrations versus the Site-specific IGW SRS, to evaluate if additional remediation is necessary.

This protocol was applied to the measured concentrations at the Site, to evaluate if the VOCs COCs detected in the LF1 soils (above the NJDEP RDC SRS and/or Default IGW SSLs) could be left in place without excavation.

6.1.1 VOCs Attainment Compliance

The VOC soil data, as presented in **Table 2a**, was evaluated to determine if any COCs exceeded the NJDEP SRS. The only VOCs COC that exceeded the SRS was Benzene, which exceeded the IGW standard. VOCs that exceed the IGW pathway cannot be addressed via an Engineering Cap, therefore, an alternative standard was calculated in accordance with the NJDEP *Technical Guidance for the Attainment of Remediation Standards and Site-Specific Criteria* using the using the Thiessen Polygon Method Average for the VOCs.

As presented in **Table 6, Figure 7,** with the Excel data and GIS shape files, the Thiessen Polygon Method average concentrations for Benzene are still above the NJDEP Default IGW SSL. Therefore, Site-Specific IGW SRS were calculated for this COCs using the SESOIL / AT123D model as detailed in the Section below (**Appendix 3**).

The selected COCs attributed to historic fill at the site, will be addressed via an Engineering Cap / Deed Restriction.

6.1.2 VOCs Site-Specific Impact to Groundwater Soil Remediation Standards

Site-Specific IGW SRS were calculated using measured soil data at the Site and SESOIL / AT123D model.

For the SESOIL model, the vadose zone thickness was considered to be 6 feet (**Table 1**). Each soil horizon maximum measured concentration was used. Since the Total Organic Carbon (TOC) to evaluate the fraction of organic carbon (foc) and the Sieve Analysis with Hydrometer (to evaluate the soil type) were not available, NJDEP default values for sand were used.

For the AT123D model, the SESOIL modeled leachate concentrations were used, along with literature values for silty sand aquifer at the Site.

The Alternative Remediation Standards (ARS), as presented in **Appendix 3**, showed that the maximum Benzene concentrations in the soil horizons at LF1 could be left in place, since the simulated AT123D groundwater concentrations below the LF1 source are decreasing below the standards within the CEA duration and extent.

6.2 Engineering (Cap) and Institutional (Deed) Control for Soils

As described in Section 2.0, the LF1 is currently in Interim Status and will be closed pursuant to the requirements for RCRA landfills specified at 40 CFR 265.310. These requirements are presented as follows:

a) At final closure of the landfill or upon closure of any cell, the owner or operator must cover the landfill or cell with a final cover designed and constructed to:

   1) Provide long-term minimization of migration of liquids through the closed landfill;
   2) Function with minimum maintenance;
   3) Promote drainage and minimize erosion or abrasion of the cover;

4) Accommodate settling and subsidence so that the cover's integrity is maintained, and;

5) Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.

b) After final closure, the owner or operator must comply with all post-closure requirements contained in 40 CFR 265.117 through 40 CFR 265.120 including maintenance and monitoring throughout the post-closure care period. The owner or operator must:

1) Maintain the integrity and effectiveness of the final cover, including making repairs to the cover as necessary to correct the effects of settling, subsidence, erosion, or other events;

2) Maintain and monitor the leak detection system in accordance with 40 CFR 264.301(c)(3)(iv) and (4) of this chapter and 40 CFR 265.304(b), and comply with all other applicable leak detection system requirements of this part;

3) Maintain and monitor the groundwater monitoring system and comply with all other applicable requirements of subpart F of this part;

4) Prevent run-on and run-off from eroding or otherwise damaging the final cover; and

5) Protect and maintain survey benchmarks used in complying with 40 CFR 265.309.

Closure of the LF1 will include the construction of a final cover system designed to meet the above-noted criteria. It is anticipated that the design of the LF-1 final cover system will be generally consistent with the EPA-recommended final cover design for RCRA Subtitle C facilities as described in EPA 625/4-91/025, Design and Construction of RCRA / CERCLA Final Covers, including the following components from the bottom up:

1. Foundation Soils - A compacted layer of foundation soils, placed and compacted to specified densities, will serve as the base upon which the subsequent final cover layers are installed. It is anticipated that the foundation soils layer will be installed with slopes of at least 3% and not greater than 5% toward the landfarm perimeter. The minimum slope is intended to allow for drainage of infiltrated liquids from the top of the overlying low hydraulic conductivity layer (see details below), with an allowance for some nominal long-term settlement. The maximum slope is intended to mitigate the potential for long-term erosion.
2. Gas Vent Layer (optional, if needed) – If required, the gas vent layer is anticipated to be 30-cm (12-in) thick, consisting of coarse-grained porous soils (similar to those used for the drainage layer, as described below). The gas vent layer would be installed above the waste materials and below the low hydraulic conductivity soil/geomembrane layer (see details below). Passive gas collection piping would be incorporated into this layer as needed, with collected gases vented to vertical risers located at high points in the cap. Although gas generation is more typically a design consideration for RCRA Subtitle D facilities, the potential need for the gas vent layer will be further evaluated as part of the detailed final cover design, based on the historic use of the

landfarm for biodegradation of waste materials and the potential high-carbon content of the remaining residuals in the landfarm.

3. Low Hydraulic Conductivity Soil/Geomembrane Layer - A 60-cm (24-inch) thick layer of compacted natural or amended soil with a hydraulic conductivity of 1 x 10-7 cm/sec or less, upon which a minimum 0.5-mm (20 mil) thick geomembrane liner is installed. Note that the EPA final cover guidance allows for alternative cover designs to be considered with appropriate justification; an example of an alternative approach for the low hydraulic conductivity soil/geomembrane layer would be the installation of a commercially-available geosynthetic clay liner (GCL) product in lieu of the low hydraulic conductivity soils. A GCL consists of a layer of low-permeability materials (e.g., bentonite) enclosed within layers of geotextile products. Provided that it is installed in accordance with the manufacturer's recommendations, a GCL offers several advantages over a layer of compacted low permeability soil, including:
    a. A GCL is a shop manufactured/tested product and offers predictable characteristics with respect to hydraulic conductivity. By contrast, natural or amended soils can have greater variation in their hydraulic conductivity characteristics.
    b. A GCL is easier to field-install, usually entailing lay-down on a properly prepared surface in the field. Natural or amended soils would require field placement and compaction in lifts, requiring a higher degree of installation effort and quality assurance/quality control (QA/QC) testing.
    c. Based on the geosynthetic materials that are integrated into typical GCL design, a GCL offers greater long-term resistance to cracking based on differential settlement, and greater stability/friction angle characteristics where steeper slopes are required.

   Based on the above, an alternative design for the low hydraulic conductivity soil/geomembrane layer may include a GCL with a hydraulic conductivity of 1 x 10-7 cm/sec or less, upon which a geomembrane liner is installed. A design entailing a single, thicker geomembrane (without the underlying low hydraulic conductivity soil layer) may also be considered in lieu of the composite soil/geomembrane layer, if it can be demonstrated that the single geomembrane would provide a level of performance consistent with the final cover criteria at 40 CFR 265.310.
4. Drainage Layer – A minimum 30-cm (12-inch) thick soil layer having a minimum hydraulic conductivity of 1 x 10-2 cm/sec, or a layer of geosynthetic material (i.e., geocomposite drainage material) having the same characteristics.
5. Soil/Vegetated Cover Layer – A minimum 60 cm (24-inch) thick cover soil layer installed over the above-noted drainage layer (with an appropriate geosynthetic filter fabric installed between the two layers). The soil cover layer will be placed and compacted to specified densities, and will have slopes of at least 3% and not greater than 5% toward the landfarm perimeter to promote stormwater runoff. If necessary, the 24-inch cover soil layer may include a layer of topsoil (for example, 18 inches of compacted soil topped with 6 inches of topsoil) to promote the establishment of vegetative cover on the final cover surface. As part of the detailed design, an armored (e.g., over-sized stone) cover may be incorporated into the cover soil layer, where necessary to prevent erosion or animal burrowing. For example, where the proposed final cover will meet the existing perimeter dike/berm along the LF-1 perimeter, the final cover slopes may be steeper (for example, up to 3H:1V), generally consistent with the outboard slopes of the existing perimeter dike/berm, so an armored cover may be more suitable for this area. In addition, the LF-1 is reportedly located

within/proximal to the 100-year flood zone (refer to **Section 3.2**), so potential armoring of the cap surface will be evaluated based on this design consideration as well.

Other Site Design Considerations:

The following items will also be addressed as part of the LF-1 closure/final cover design:

1. Site Security – The need for security measures limiting access to the LF-1 facility will be evaluated. The LF-1 facility currently has chain link security fencing installed around the facility perimeter, so additional fencing for site security is not anticipated at this time.
2. Lysimeters - A number of existing four-inch diameter PVC lysimeters are installed within the LH-1 footprint and will be abandoned as part of the final cover installation. It is anticipated that each lysimeter will be grouted closed with a lean concrete mixture and cut so the top is below grade and covered with stone. The work will be performed by a New Jersey-licensed driller.
3. Other Existing Landfarm Infrastructure – As described above, the LF-1 facility is furnished with an underlying liquid (i.e., leachate) collection system, which conveys collected liquids to a central collection sump/vault located just outside the northern corner of the landfarm footprint. The final cover will be designed to coordinate and avoid interference with the existing liquid collection system infrastructure.
4. Cap Drainage – Cap drainage features will be incorporated to promote positive drainage off the cap and manage cap drainage to minimize erosion or abrasion of the cover and direct it to points of discharge.

Pre-Design Investigations:

The following pre-design investigation (PDI) activities are anticipated to be required in support of the final cover design:

1. Geotechnical Borings – A series of geotechnical borings would be completed within and along the perimeter of the LF-1 footprint, with collection of samples for geotechnical testing/parameters evaluation as appropriate, to evaluate the geotechnical characteristics of the waste materials, and underlying native soil strata. These data will allow an evaluation of the long-term cap stability and potential for settlement.
2. Site Survey – A topographic land/site features survey of the LF-1 facility will be completed to provide the existing site grading information required for the detailed cover design. To the degree feasible, the surveying work will be used to identify the as-constructed features of the landfarm's underlying liquid management system.
3. Liquid Management System – Field inspection and verification of selected aspects of the landfarm's liquid management system and other as-built features may be required as part of the detailed final cover design.

Preliminary (30%) Final Cover Design Report:

Following agency approval of this RAWP, the PDI activities (refer to preliminary listing noted above) will be conducted to provide the required information for the final cover design. Using the PDI information, a Preliminary (30%) Final Cover Design Report will be prepared, anticipated to include the following:

1. Basis of design narrative, summarizing the final cover design objectives, the key components of the cover design, and specifications for anticipated key components and materials (e.g., geomembrane, GCL, geotextiles), with selected supporting calculations as appropriate.
2. Preliminary final cover design drawings, including final cover plans, cross-sections, and selected details.
3. Preliminary specifications for the final cover construction
4. A schedule for the completion of the final cover design and the final cover installation work.

The preliminary final cover design report will be prepared by a New Jersey licensed professional engineer. The preliminary design report will also include a preliminary description of the anticipated post-closure operations, maintenance, and monitoring program for LF-1, in accordance with the post-closure requirements contained in 40 CFR 265.117 through 40 CFR 265.120.

A Deed Restriction application and a RAP for Soils will be submitted, to address SVOCs and metals, as well as possible TPH and PCBs soil impacts via capping.

6.3 Classification Exception Area

Based on the results of the groundwater sampling, no active remediation is proposed for AOC-3: LF1. A CEA is proposed to address the groundwater contamination with monitored natural attenuation (MNA) as the remedy. The COCs for groundwater at the LF1 are:

- SVOCs: bis(2-ethylhexyl) phthalate,
- Metals: arsenic and lead.

For aluminum, iron, manganese, and sodium, which were also detected at concentrations above the NJDEP GWQS, a CEA is not proposed. These constituents are considered background, since they were not associated with the Site operations. Also, they are considered secondary contaminants, since they have the standards based primarily on aesthetic considerations such as taste, odor, and appearance and not based on health risk assessment.

Based on preliminary fate and transport modeling of the SVOCs and metals and the COCs in groundwater, it appears that the CEA will not extend off-site of the LF1 area, due to SVOC and metals slow migration, and the proposed duration will be indeterminate, due to the low depletion of the SVOCs and metals.

The CEA documentation and RAP will be prepared and submitted with the Remedial Action Report.

6.4 Post-Closure Monitoring Plan

Continued monitoring will be conducted to ensure the proposed CEA remains protective of human health and the environment. Therefore, all the wells historically used to monitor the LF1 contaminant migration, L1-1 through L1-4, as well as BG-2 and BG-3, will be sampled annually for:

- SVOCs: bis(2-ethylhexyl) phthalate,
- Metals: arsenic and lead.
- General Chemistry data consisting of
  - Field Parameters (pH, Redox, Specific Conductance, Temperature and Turbidity).

The NJDEP Groundwater RAP will provide the specific monitoring conditions required for the Site's CEA. Biennial Protectiveness Monitoring reports will be submitted to the NJDEP, as specified in the Groundwater RAP application.

A QAPP for groundwater monitoring is provided in **Appendix 4**. The monitoring wells will be sampled utilizing low flow sampling with purge rates monitored and adjusted to stabilize drawdown.

7.0 CONCLUSIONS

Based on the SI/RI activities, the RAW/ PCMP prepared for the LF1 includes:

- An evaluation of VOCs residual soil contamination to address the IGW pathway, using the NJDEP Attainment Guidance and / or IGW Guidance;

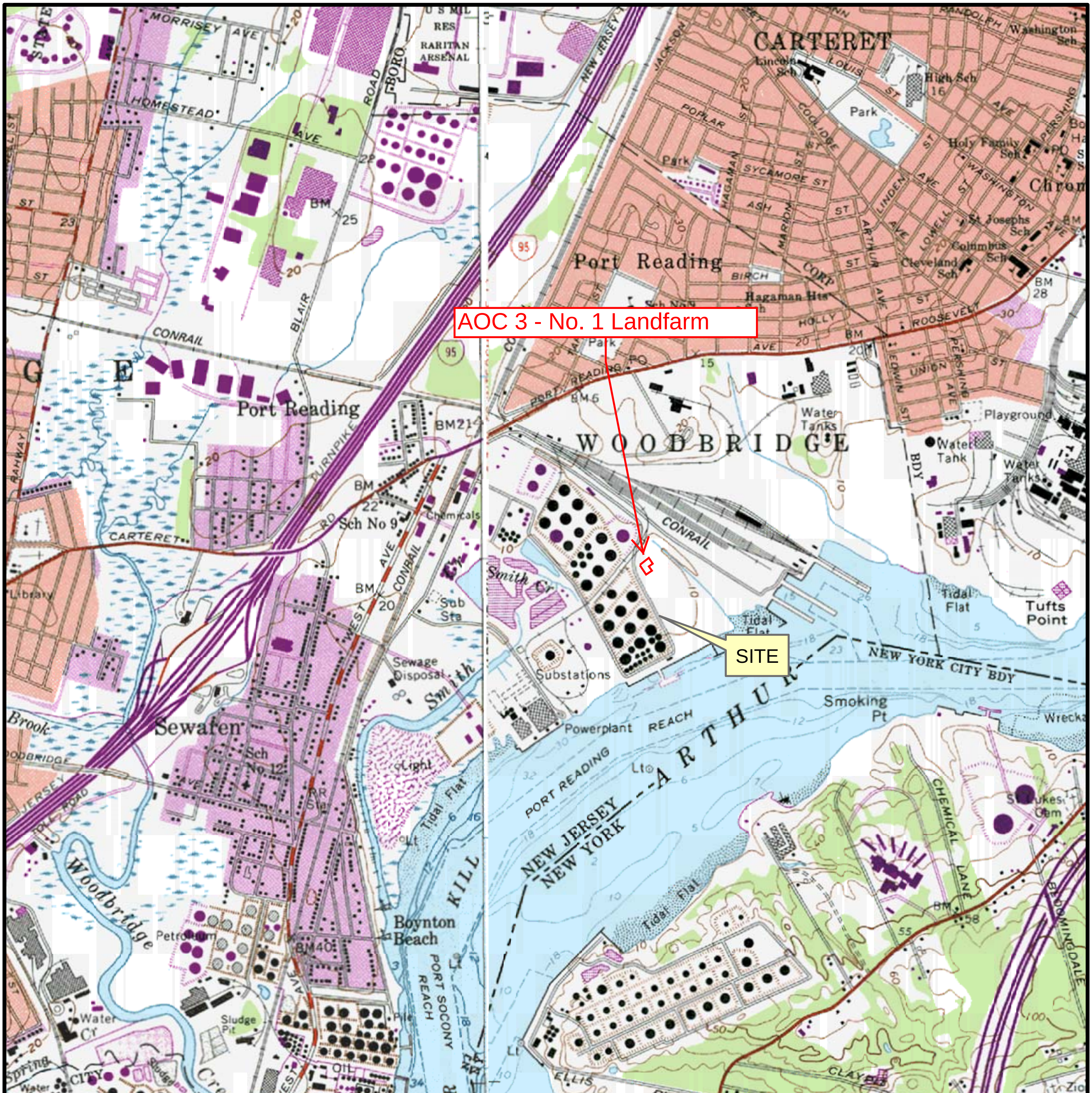
- A Cap with a Deed Restriction and a RAP for soils;

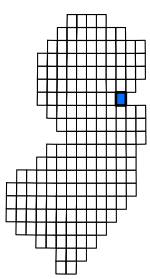
- A CEA and a RAP for groundwater, and

- A PCMP.

A Remedial Action Report containing the soil and groundwater RAP will be submitted to the NJDEP once the Cap and Deed Restriction have been completed. A Conditional RAO will be issued upon receipt of the approved RAPs by the Site's LSRP of record, for the Site's AOC-3: LF1.

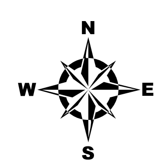
FIGURES





QUADRANGLE LOCATION:
ARTHUR KILL, NEW JERSEY

SOURCE: ENVIROTRAC



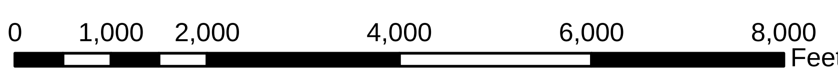


FIGURE 1	U.S.G.S. TOPOGRAPHIC MAP HESS - PORT READING 750 CLIFF ROAD PORT READING, NEW JERSEY	PROJECT # PR DATE: 11/24/2015	Earth Systems Environmental Engineering 43 W. Front Street, Keyport, NJ 07735 T. 732.739.6444 | F. 732.739.0451

LEGEND

Middlesex County Parcels

Property Boundaries

Landfarms Areas of Concern
AOC-1: North Landfarm (NLF)
AOC-2: South Landfarm (SLF)
AOC-3: Landfarm No.1 (LF1)

Map Scale in Feet

0 1000 2000 3000 4000

Source:

1) Property Parcels from NJDEP Middlesex Shape File

HESS - PORT READING
750 CLIFF ROAD
PORT READING, NEW JERSEY

Project Number: PR	Date: November 13, 2015

Earth Systems
Environmental Engineering

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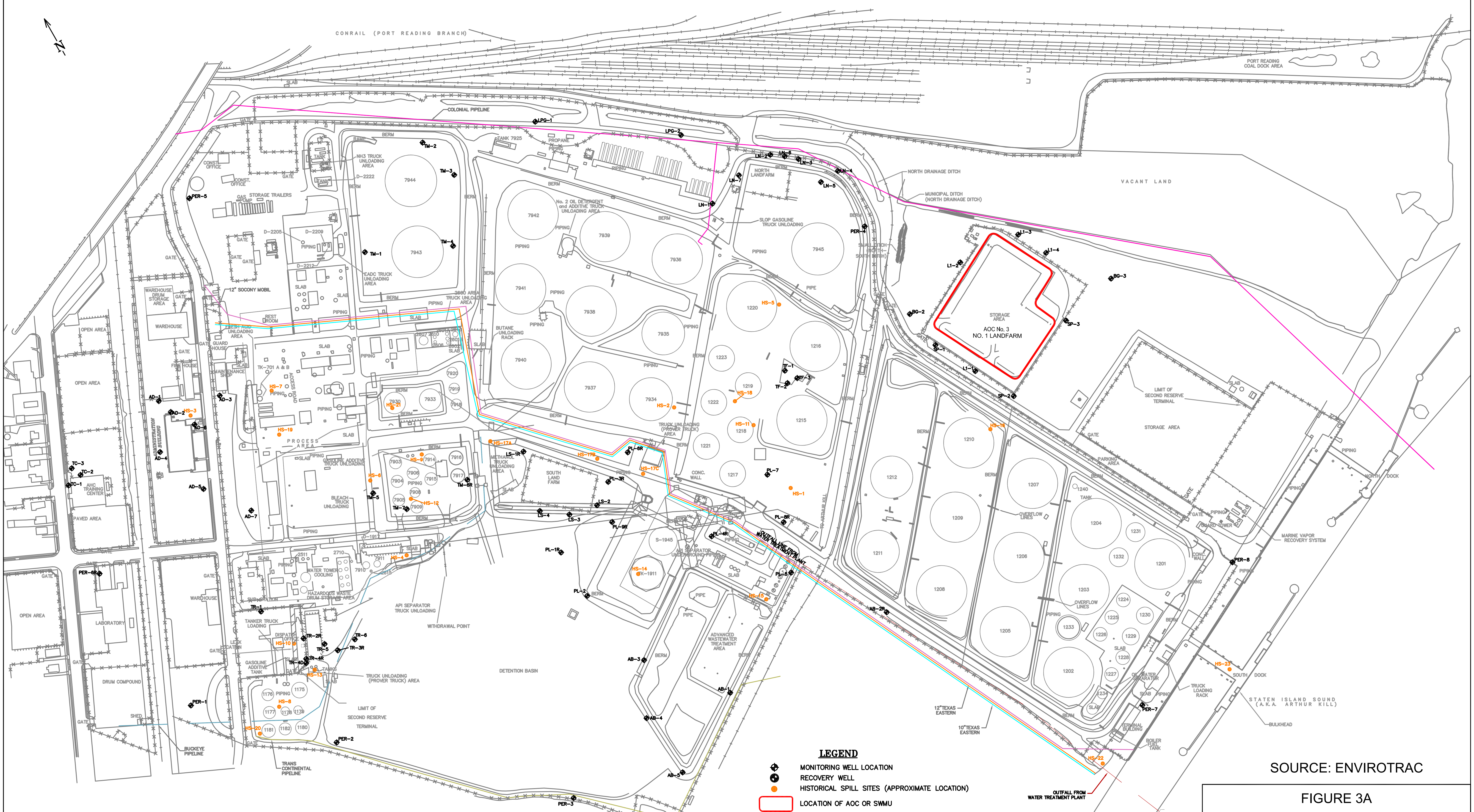
This map was developed using New Jersey Department of Environmental Protection Geographic Information System Digital Data, but this secondary product has not been verified by NJDEP and is not state Authorized.

Figure 2 - Site Layout Map with the Landfarms Areas of Concern



NOTES:

1. AOC – AREA OF CONCERN
2. SWMU – SOLID WASTE MANAGEMENT UNIT
3. UST – UNDERGROUND STORAGE TANK
4. AST – ABOVCE GROUND STORAGE TANK
5. SOCONY/MOBILE LINE IS THE OLD COLONIAL LINE. THIS WAS A COLONIAL PIPELINE TIE IN FOR SOCONY MOBIL. IT WAS ABANDONED IN PLACE. IT WAS CAPPED OFF AT THE SOUTH DOCK. THE LINE UNDER ARTHUR KILL IS UNDER NITROGEN BLANKET.
6. AOC BORDERS WILL MODIFY IN ACCORDANCE WITH FIELD INVESTIGATION RESULTS

FIGURE 3A

PROPERTY MAP
AOC 3 - No. 1 LANDFARM

HESS - PORT READING
750 CLIFF ROAD
PORT READING, NEW JERSEY

PROJECT # PR

0 150
SCALE IN FEET

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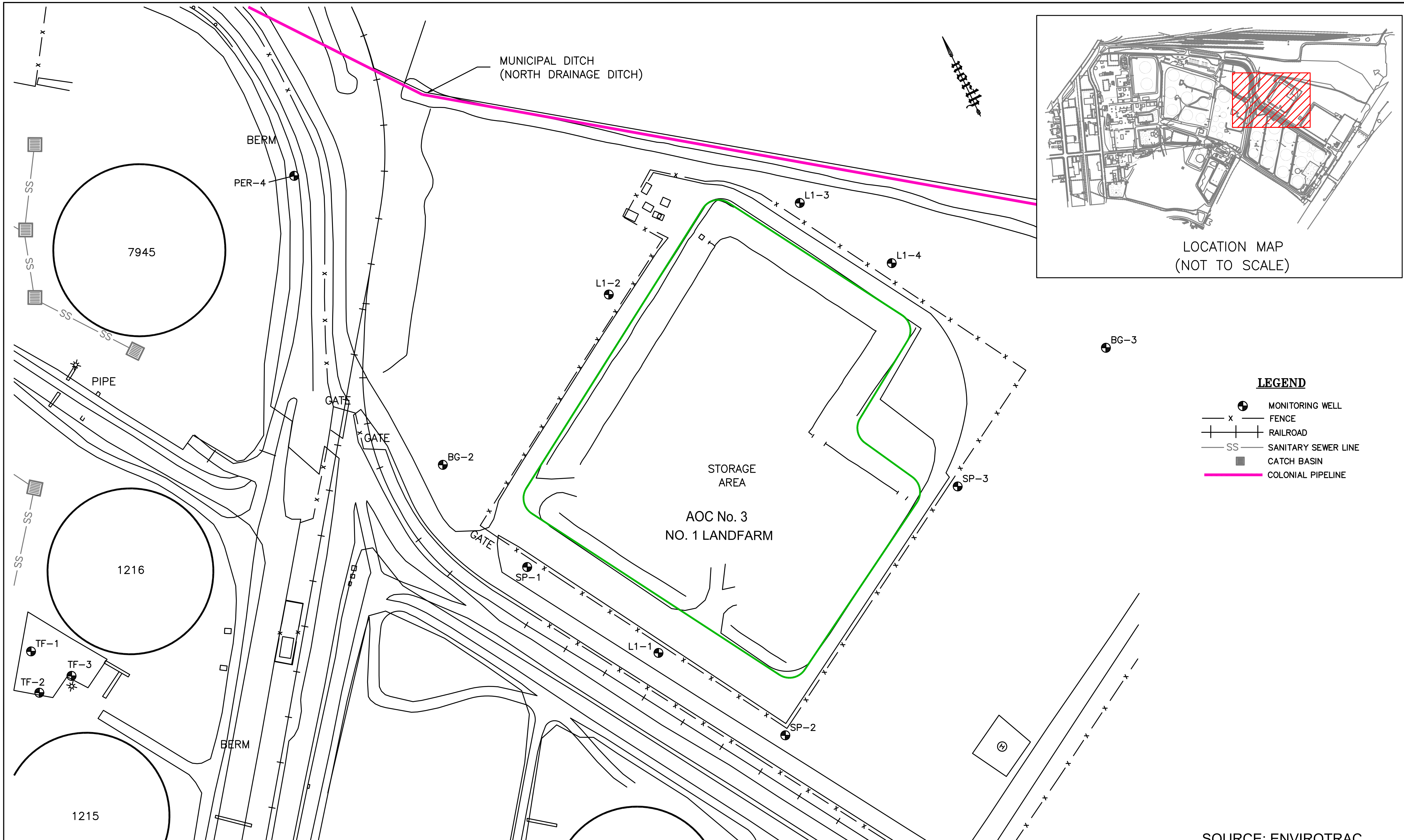

FIGURE 3B	HESS - PORT READING 750 CLIFF ROAD PORT READING, NEW JERSEY	PROPERTY MAP AOC-3 – No. 1 LANDFARM PROJECT # PR — DATE: 11/24/2015	0 100 SCALE IN FEET

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LEGEND

Property Parcels

Landfarm No. 1 (LF1)

Monitoring Wells

Soil Samples

Map Scale in Feet

0 100 200 300 400

Source:

1) Property Parcels from NJDEP Middlesex Shape File

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750 CLIFF ROAD
PORT READING, NEW JERSEY

Project Number: PR	Date: November 13, 2015

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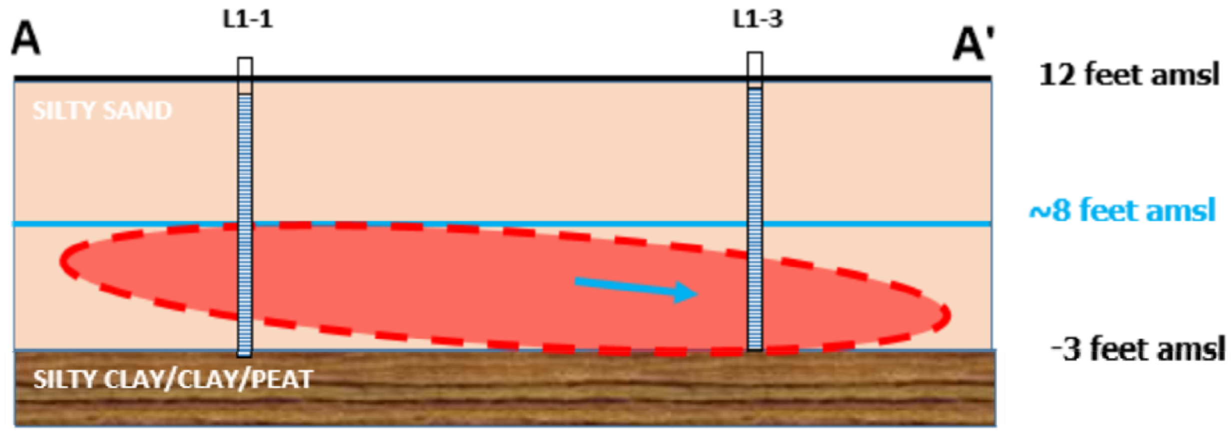
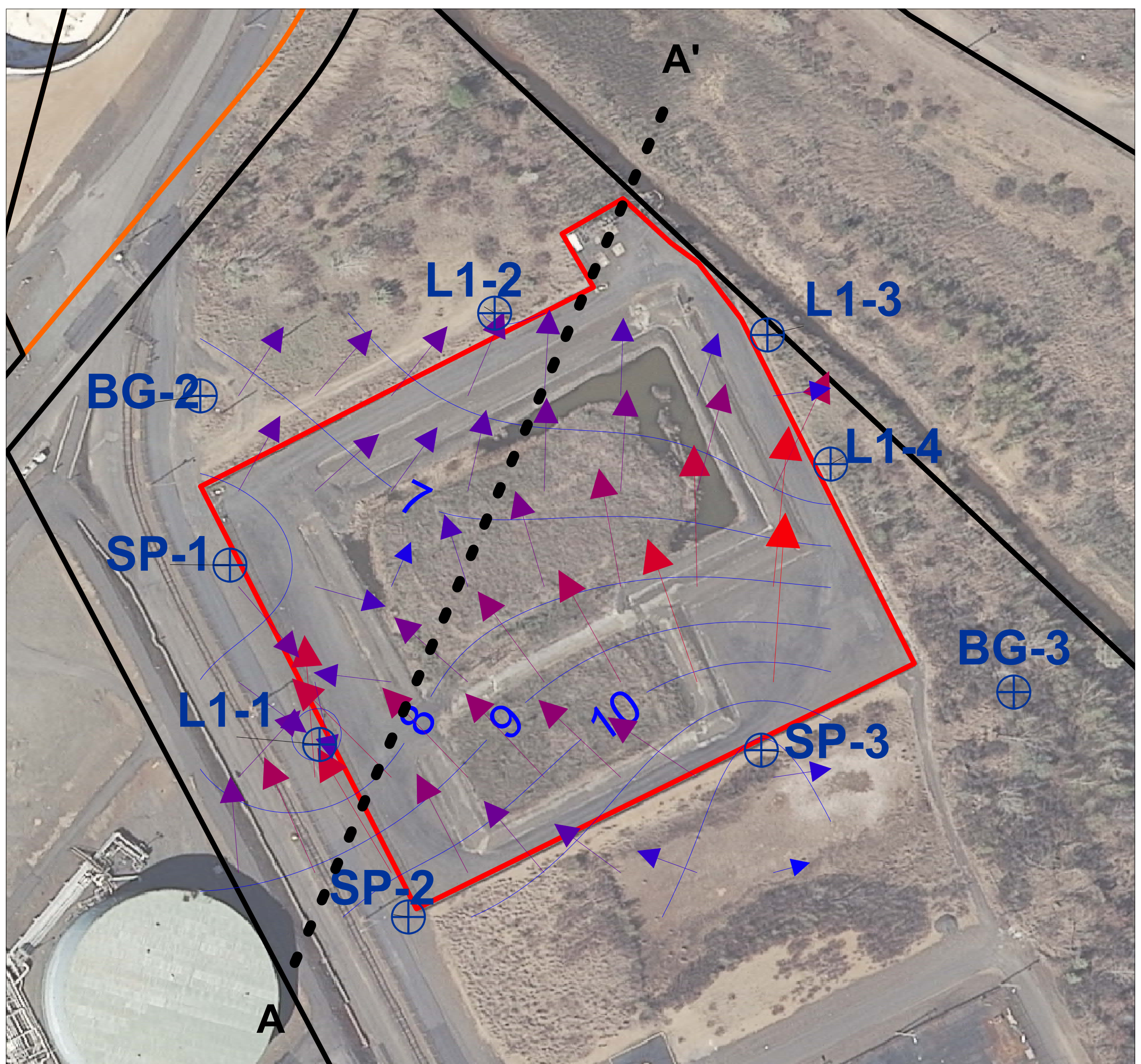
Figure 4 - AOC-3: LF1 2014 Soil Sample Locations





LEGEND

Property Parcels

Landfarm No. 1 (LF1)

Monitoring Wells with Groundwater Elevations

Groundwater Elevation Contours and Flow Direction January 19, 2015 Data

0.03
0.025
0.02
0.015
0.01
0.005

Hydraulic Gradient (feet / feet)

Map Scale in Feet

0 100 200 300 400

Source:

1) Property Parcels from NJDEP Middlesex Shape File

HESS - PORT READING
750 CLIFF ROAD
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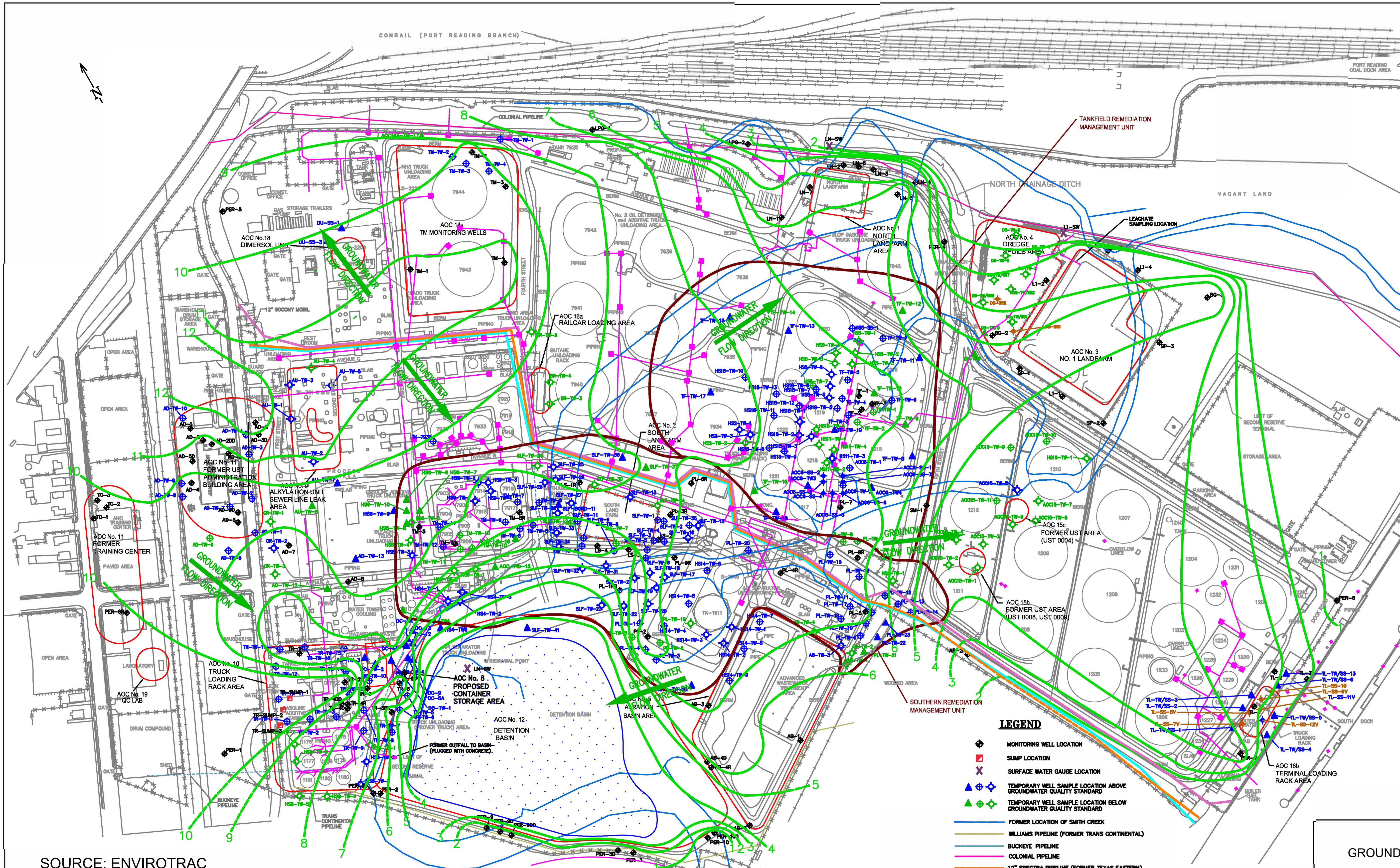
Figure 5 - AOC-3: LF1 Site Generalized Cross-Section



SOURCE: ENVIROTRAC

MONITORING POINT	DEPTH TO BOTTOM	KNOWN ELEVATION	DEPTH TO WATER	DEPTH TO PRODUCT	GROUNDWATER ELEVATION
DB-SW	–	10.72	3.12	–	3.34
AB-1	13.10	13.85	8.65	–	5.20
AB-2R	21.05	10.81	8.06	–	2.75
AB-3	13.10	14.62	7.27	–	7.35
AB-4	4.85	14.24	DRY	–	–
AB-5	13.08	13.24	8.51	–	4.73
AD-1	10.93	18.25	6.33	–	11.92
AD-2	17.15	18.95	7.97	–	10.98
AD-3	13.88	22.00	9.82	–	12.18
AD-4	14.88	17.55	7.90	–	9.65
AD-5	13.09	17.73	8.16	–	9.57
AD-6	14.60	19.18	8.21	–	10.97
AD-7	19.76	13.32	4.89	–	8.43
AD-8	14.74	15.88	6.39	–	9.49
BG-2	11.00	11.13	6.64	–	4.49
BG-3	10.78	12.54	6.58	–	5.96
L1-1	14.70	13.38	8.56	–	4.82
L1-2	14.31	10.98	7.19	–	3.79
L1-3	10.97	11.50	8.06	–	3.44
L1-4	11.04	12.97	9.69	–	3.28
L1-SW	–	5.48	1.34	–	1.32
LN-1	13.33	12.19	6.86	–	5.33
LN-2	11.38	12.21	7.24	–	4.97
LN-3	13.12	11.34	6.62	–	4.72
LN-4	14.21	13.55	8.76	–	4.79
LN-5	16.93	12.85	6.13	–	6.72
LN-6	17.10	14.56	9.74	–	4.82
LN-7	16.90	15.75	9.87	–	5.88
LN-SW	–	5.19	1.90	–	1.59
LPG-1	8.10	13.74	7.63	–	6.11
LPG-2	9.69	9.30	5.89	–	3.41
LS-1R	15.90	14.49	4.97	–	9.52
LS-2	11.93	11.69	2.99	–	8.70
LS-3	12.66	8.30	1.92	–	6.38
LS-4	13.26	11.25	4.12	–	7.13
PER-1	19.26	19.29	9.17	–	10.12
PER-2	12.19	12.91	6.21	–	6.70
PER-3	12.20	9.55	8.47	–	1.08
PER-4	15.67	10.23	7.89	–	2.34
PER-5	14.40	20.47	11.27	–	9.20
PER-6R	21.97	23.76	13.64	–	10.12
PER-7	16.63	11.15	6.89	–	4.26
PER-8	14.58	7.48	6.51	–	0.97
PER-9	17.89	8.45	6.49	–	1.96
PER-10	18.87	12.18	11.63	–	0.55
PL-1RR	–	7.35	1.68	1.67	5.68
PL-2	–	11.78	3.23	3.21	8.56
PL-3R	18.60	12.27	3.87	–	8.40
PL-4R	20.85	12.40	4.59	–	7.81
PL-5	–	9.08	1.99	1.98	7.10
PL-6R	21.62	11.49	3.97	–	7.52
PL-7	19.58	13.06	5.59	–	7.47
PL-8R	21.76	11.96	4.77	–	7.19
PL-9R	20.84	11.26	4.10	–	7.16
SP-1	11.97	9.22	8.48	–	0.74
SP-2	12.26	10.73	9.19	–	1.54
SP-3	11.98	9.29	8.44	–	0.85
TC-1	17.75	20.48	10.60	–	9.88
TC-2	14.88	19.57	9.71	–	9.86
TC-3	17.18	19.55	9.64	–	9.91
TM-1	20.78	22.36	11.24	–	11.12
TM-2	22.20	22.22	12.16	–	10.29
TM-3	20.75	22.50	12.18	–	10.32
TM-4	15.35	21.14	9.97	–	11.17
TM-5	22.10	18.47	9.24	–	9.23
TM-6R	19.95	14.06	5.92	–	8.14
TM-7	–	17.03	8.17	8.16	8.87
TF-1	12.15	10.82	3.53	–	7.29
TF-2	–	NM	7.13	7.12	–
TF-3	11.80	10.73	3.23	–	7.50
TL-1	12.68	8.76	5.82	–	2.94
TL-2	14.54	8.44	5.39	–	3.05
TL-3	9.88	8.62	5.84	–	2.78
TR-1R	15.02	13.70	6.39	–	7.31
TR-2R	–	14.66	4.09	4.08	10.58
TR-3RR	14.66	9.65	3.68	–	5.97
TR-4R	14.59	12.10	3.89	–	8.21
TR-5	10.58	12.00	5.82	–	6.18
TR-6	10.71	12.90	5.52	–	7.38

LEGEND

- MONITORING WELL LOCATION
- SUMP LOCATION
- SURFACE WATER GAUGE LOCATION
- TEMPORARY WELL SAMPLE LOCATION ABOVE GROUNDWATER QUALITY STANDARD
- TEMPORARY WELL SAMPLE LOCATION BELOW GROUNDWATER QUALITY STANDARD
- FORMER LOCATION OF SMITH CREEK
- WILLIAMS PIPELINE (FORMER TRANS CONTINENTAL)
- BUCKEYE PIPELINE
- COLONIAL PIPELINE
- 12" SPECTRA PIPELINE (FORMER TEXAS EASTERN)
- 10" ABANDONED SPECTRA PIPELINE (FORMER TEXAS EASTERN)
- ABANDONED COLONIAL PIPELINE
- LOCATION OF REMEDIAL MANAGEMENT UNIT
- RAILROAD
- PROCESS/STORM SEWER LINE
- SURFACE WATER (Approximate)
- LOCATION OF KNOWN AOC

NOTES:

1. AOC – AREA OF CONCERN
2. SWMU – SOLID WASTE MANAGEMENT UNIT
3. UST – UNDERGROUND STORAGE TANK
4. AST – ABOVE GROUND STORAGE TANK
5. AOC BORDERS WILL MODIFY IN ACCORDANCE WITH FIELD INVESTIGATION RESULTS
6. AOCs 97 ABOVE GROUND PIPING RUNS
7. [illegible] UTILIZED TO MAKE GROUNDWATER CONTOURS
8. MONITORING POINTS SP–1, SP–2. SP–3 WERE NOT UTILIZED TO CREATE GROUNDWATER CONTOURS
9. NOVEMBER 12, 2013 GAUGING DATA WAS UTILIZED FOR MONITORING POINTS AD–7, AD–8, AD–9D

FIGURE 6A

GROUNDWATER ELEVATION CONTOURS

NOVEMBER 11, 2013

HESS - PORT READING

750 CLIFF ROAD

PORT READING, NEW JERSEY

PROJECT # PR

DATE 11/8/2015

0 150 SCALE IN FEET

Earth Systems
Environmental Engineering
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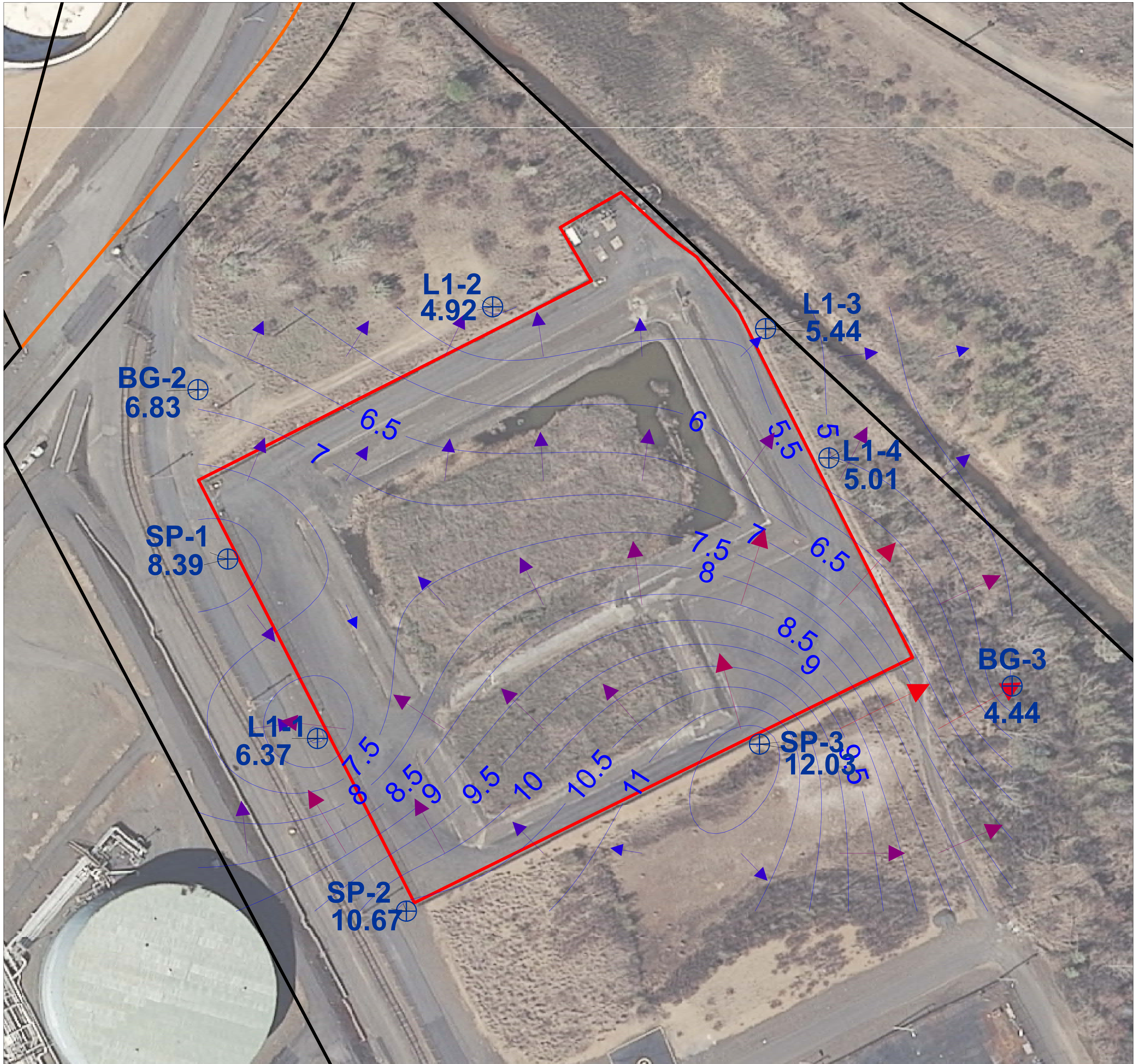

LEGEND

Property Parcels

Landfarm No. 1 (LF1)

Monitoring Wells with Groundwater Elevations

Groundwater Elevation Contours and Flow Direction

0.035
0.03
0.025
0.02
0.015
0.01
0.005

Hydraulic Gradient (feet / feet)

Map Scale in Feet

0 100 200 300 400

Source:

1) Property Parcels from NJDEP Middlesex Shape File

HESS - PORT READING
750 CLIFF ROAD
PORT READING, NEW JERSEY

Project Number: PR	Date: November 13, 2015

Earth Systems
Environmental Engineering

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Figure 6b - Groundwater Contour Map (LF1) - April 21, 2015

LEGEND

Property Parcels

Landfarm No. 1 (LF1)

Monitoring Wells

Soil Samples

Thiessen Polygons

Map Scale in Feet

0 100 200 300 400

Source:

1) Property Parcels from NJDEP Middlesex Shape File

HESS - PORT READING
750 CLIFF ROAD
PORT READING, NEW JERSEY

Project Number: PR	Date: November 13, 2015

Earth Systems
Environmental Engineering

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Figure 7 - LF1 Soil Sample Locations and Thiessen Polygons

TABLES

Table 1
Monitoring Wells Construction Information and Groundwater Elevation Data
AOC-3: LF1
Hess- Corporation - Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Well ID	Well Permit #	X_NAD83	Y_NAD83	Well Diameter (inches)	Total Depth Drilled (feet)	Well Screen (feet)	Ground Elevation (feet above mean sea level)	Top of Casing (TOC) Elevation (feet above mean sea level)	October 22, 2012		January 14, 2013	
									Depth to Groundwater from TOC	Groundwater Elevation (feet above mean sea level)	Depth to Groundwater from TOC	Groundwater Elevation (feet above mean sea level)
L1-1	26000806801	563,950	629,483	4	15	5-15	12.8	13.38	7.45	5.93	6.14	7.24
L1-2	2600080656	564,098	629,848	4	14	4-14	10	10.98	6.65	4.33	5.76	5.22
L1-3	2600080664	564,329	629,829	4	9.5	4.5-9.5	10.3	11.50	6.65	4.85	5.76	5.74
L1-4	2600080672	564,383	629,720	4	9	4-9	11.1	12.97	8.57	4.40	7.83	5.14
BG-2	2600031926	563,849	629,778	4	11	IU	9.62	11.13	4.62	6.51	3.84	7.29
BG-3	2600031926	564,538	629,527	4	10	5-10	NA	12.54	4.80	7.74	2.75	NA
SP-1	2600025338	563,874	629,634	2	15	5-15	NA	14.07	6.20	7.87	5.65	8.42
SP-2	2600025339	564,025	629,337	2	15	5-15	NA	15.24	8.65	6.59	7.66	7.58
SP-3	2600025340	564,324	629,478	2	15	5-15	NA	14.66	7.40	NA	6.11	8.55
Hydraulic gradient, i, between L1-1 and L1-4									0.003		0.004	
Minimum Depth to Groundwater								**3**	4.6		2.8	
Maximum Depth to Groundwater								**8**	8.7		7.8	
Average i									**0.004**			
Average Depth to Groundwater									**6**			

Table 1
Monitoring Wells Construction Information and Groundwater Elevation Data
AOC-3: LF1
Hess- Corporation - Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Well ID	Well Permit #	X_NAD83	Y_NAD83	Well Diameter (inches)	Total Depth Drilled (feet)	Well Screen (feet)	Ground Elevation (feet above mean sea level)	Top of Casing (TOC) Elevation (feet above mean sea level)	April 22, 2013		July 22, 2013	
									Depth to Groundwater from TOC	Groundwater Elevation (feet above mean sea level)	Depth to Groundwater from TOC	Groundwater Elevation (feet above mean sea level)
L1-1	26000806801	563,950	629,483	4	15	5-15	12.8	13.38	6.92	6.46	5.65	7.73
L1-2	2600080656	564,098	629,848	4	14	4-14	10	10.98	6.42	4.56	5.35	5.63
L1-3	2600080664	564,329	629,829	4	9.5	4.5-9.5	10.3	11.50	6.42	5.08	5.35	6.15
L1-4	2600080672	564,383	629,720	4	9	4-9	11.1	12.97	8.10	4.87	7.17	5.80
BG-2	2600031926	563,849	629,778	4	11	IU	9.62	11.13	4.73	6.40	NA	NA
BG-3	2600031926	564,538	629,527	4	10	5-10	NA	12.54	4.45	NA	5.60	NA
SP-1	2600025338	563,874	629,634	2	15	5-15	NA	14.07	6.13	7.94	4.60	9.47
SP-2	2600025339	564,025	629,337	2	15	5-15	NA	15.24	7.82	7.42	4.70	10.54
SP-3	2600025340	564,324	629,478	2	15	5-15	NA	14.66	6.40	8.26	4.61	10.05
Hydraulic gradient, i, between L1-1 and L1-4									0.003		0.004	
Minimum Depth to Groundwater								**3**	4.5		4.6	
Maximum Depth to Groundwater								**8**	8.1		7.2	
Average i									**0.004**			
Average Depth to Groundwater									**6**			

Table 1
Monitoring Wells Construction Information and Groundwater Elevation Data
AOC-3: LF1
Hess- Corporation - Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Well ID	Well Permit #	X_NAD83	Y_NAD83	Well Diameter (inches)	Total Depth Drilled (feet)	Well Screen (feet)	Ground Elevation (feet above mean sea level)	Top of Casing (TOC) Elevation (feet above mean sea level)	October 7, 2013		January 13, 2014	
									Depth to Groundwater from TOC	Groundwater Elevation (feet above mean sea level)	Depth to Groundwater from TOC	Groundwater Elevation (feet above mean sea level)
L1-1	26000806801	563,950	629,483	4	15	5-15	12.8	13.38	5.71	7.67	6.63	6.75
L1-2	2600080656	564,098	629,848	4	14	4-14	10	10.98	5.41	5.57	6.45	4.53
L1-3	2600080664	564,329	629,829	4	9.5	4.5-9.5	10.3	11.50	5.41	6.09	6.45	5.05
L1-4	2600080672	564,383	629,720	4	9	4-9	11.1	12.97	7.28	5.69	7.61	5.36
BG-2	2600031926	563,849	629,778	4	11	IU	9.62	11.13	NA	NA	3.72	7.41
BG-3	2600031926	564,538	629,527	4	10	5-10	NA	12.54	5.62	NA	2.80	NA
SP-1	2600025338	563,874	629,634	2	15	5-15	NA	14.07	4.63	9.44	5.57	8.50
SP-2	2600025339	564,025	629,337	2	15	5-15	NA	15.24	4.80	10.44	5.00	10.24
SP-3	2600025340	564,324	629,478	2	15	5-15	NA	14.66	4.72	9.94	3.11	11.55
Hydraulic gradient, i, between L1-1 and L1-4									0.004		0.003	
Minimum Depth to Groundwater								**3**	4.6		2.8	
Maximum Depth to Groundwater								**8**	7.3		7.6	
Average i									**0.004**			
Average Depth to Groundwater									**6**			

Table 1
Monitoring Wells Construction Information and Groundwater Elevation Data
AOC-3: LF1
Hess- Corporation - Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Well ID	Well Permit #	X_NAD83	Y_NAD83	Well Diameter (inches)	Total Depth Drilled (feet)	Well Screen (feet)	Ground Elevation (feet above mean sea level)	Top of Casing (TOC) Elevation (feet above mean sea level)	April 21, 2014		July 21, 2014	
									Depth to Groundwater from TOC	Groundwater Elevation (feet above mean sea level)	Depth to Groundwater from TOC	Groundwater Elevation (feet above mean sea level)
L1-1	26000806801	563,950	629,483	4	15	5-15	12.8	13.38	5.60	7.78	5.34	8.04
L1-2	2600080656	564,098	629,848	4	14	4-14	10	10.98	6.28	4.70	6.03	4.95
L1-3	2600080664	564,329	629,829	4	9.5	4.5-9.5	10.3	11.50	6.28	5.22	6.03	5.47
L1-4	2600080672	564,383	629,720	4	9	4-9	11.1	12.97	7.90	5.07	7.65	5.32
BG-2	2600031926	563,849	629,778	4	11	IU	9.62	11.13	4.00	7.13	3.73	7.40
BG-3	2600031926	564,538	629,527	4	10	5-10	NA	12.54	6.64	NA	6.43	NA
SP-1	2600025338	563,874	629,634	2	15	5-15	NA	14.07	5.23	8.84	4.41	9.66
SP-2	2600025339	564,025	629,337	2	15	5-15	NA	15.24	4.40	10.84	4.27	10.97
SP-3	2600025340	564,324	629,478	2	15	5-15	NA	14.66	2.55	12.11	2.32	12.34
Hydraulic gradient, i, between L1-1 and L1-4										0.005		0.006
Minimum Depth to Groundwater								**3**	2.6		2.3	
Maximum Depth to Groundwater								**8**	7.9		7.7	
Average i									**0.004**			
Average Depth to Groundwater									**6**			

Table 1
Monitoring Wells Construction Information and Groundwater Elevation Data
AOC-3: LF1
Hess- Corporation - Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Well ID	Well Permit #	X_NAD83	Y_NAD83	Well Diameter (inches)	Total Depth Drilled (feet)	Well Screen (feet)	Ground Elevation (feet above mean sea level)	Top of Casing (TOC) Elevation (feet above mean sea level)	October 13, 2014		January 19, 2015	
									Depth to Groundwater from TOC	Groundwater Elevation (feet above mean sea level)	Depth to Groundwater from TOC	Groundwater Elevation (feet above mean sea level)
L1-1	26000806801	563,950	629,483	4	15	5-15	12.8	13.38	7.36	6.02	6.73	6.65
L1-2	2600080656	564,098	629,848	4	14	4-14	10	10.98	6.70	4.28	6.09	4.89
L1-3	2600080664	564,329	629,829	4	9.5	4.5-9.5	10.3	11.50	6.70	4.80	6.09	5.41
L1-4	2600080672	564,383	629,720	4	9	4-9	11.1	12.97	8.55	4.42	7.93	5.04
BG-2	2600031926	563,849	629,778	4	11	IU	9.62	11.13	4.89	6.24	3.71	7.42
BG-3	2600031926	564,538	629,527	4	10	5-10	NA	12.54	6.01	NA	2.62	NA
SP-1	2600025338	563,874	629,634	2	15	5-15	NA	14.07	6.23	7.84	5.34	8.73
SP-2	2600025339	564,025	629,337	2	15	5-15	NA	15.24	6.13	9.11	4.41	10.83
SP-3	2600025340	564,324	629,478	2	15	5-15	NA	14.66	4.67	9.99	2.35	12.31
Hydraulic gradient, i, between L1-1 and L1-4										0.003	0.003	
Minimum Depth to Groundwater								**3**	4.7		2.4	
Maximum Depth to Groundwater								**8**	8.6		7.9	
Average i									**0.004**			
Average Depth to Groundwater									**6**			

Table 1
Monitoring Wells Construction Information and Groundwater Elevation Data
AOC-3: LF1
Hess- Corporation - Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Well ID	Well Permit #	X_NAD83	Y_NAD83	Well Diameter (inches)	Total Depth Drilled (feet)	Well Screen (feet)	Ground Elevation (feet above mean sea level)	Top of Casing (TOC) Elevation (feet above mean sea level)	April 21, 2015 Depth to Groundwater from TOC	April 21, 2015 Groundwater Elevation (feet above mean sea level)
L1-1	26000806801	563,950	629,483	4	15	5-15	12.8	13.38	7.01	6.37
L1-2	2600080656	564,098	629,848	4	14	4-14	10	10.98	6.06	4.92
L1-3	2600080664	564,329	629,829	4	9.5	4.5-9.5	10.3	11.50	6.06	5.44
L1-4	2600080672	564,383	629,720	4	9	4-9	11.1	12.97	7.96	5.01
BG-2	2600031926	563,849	629,778	4	11	IU	9.62	11.13	4.30	6.83
BG-3	2600031926	564,538	629,527	4	10	5-10	NA	12.54	8.10	4.44
SP-1	2600025338	563,874	629,634	2	15	5-15	NA	14.07	5.68	8.39
SP-2	2600025339	564,025	629,337	2	15	5-15	NA	15.24	4.57	10.67
SP-3	2600025340	564,324	629,478	2	15	5-15	NA	14.66	2.63	12.03
Hydraulic gradient, i, between L1-1 and L1-4									0.003	
Minimum Depth to Groundwater								**3**	2.6	
Maximum Depth to Groundwater								**8**	8.1	
Average i									**0.004**	
Average Depth to Groundwater									**6**	

Table 2a - Soil Data - VOCs
No. 1 Landfarm Soil Core Monitoring Summary
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Volatile Organic												
Sample Location	Sample Date	Approximate Elevation Above Mean Sea Level (feet)	Benzene (CAS # 9072-35-9)	2-Butanone (MEK) (CAS # 78-93-3)	Carbon disulfide (CAS # 75-15-0)	Chlorobenzene (CAS # 108-90-7)	1,2- Dichlorobenzene (CAS # 95-50-1)	Ethylbenzene (CAS # 100-41-4)	MTBE (CAS # 1634-04-4)	TBA (CAS # 75-64-0)	Toluene (CAS # 108-88-3)	Xylene (total) (CAS # 1330-20-7)
NRDC SRS			5	44,000	110,000	7,400	59,000	110,000	320	11,000	91,000	170,000
RDC SRS			2	3,100	7,800	510	5,300	7,800	110	1,400	6,300	12,000
IGW SSL			0.005	0.9	6	0.6	17	13	0.2	0.3	7	19
Maximum Concentration			**0.156**	**0.078**	**3.2**	**ND**	**0.00038**	**0.643**	**0.003**	**ND**	**0.308**	**1.97**
Minimum Concentration			**0.0012**	**0.0035**	**0.00094**	**ND**	**ND**	**0.00062**	**0.0006**	**ND**	**0.00049**	**0.0018**
Z0I	7/12/2000	13.0-13.5	ND	ND	0.0042	NR	NR	0.0025	NS	NS	ND	0.00433
	7/11/2001		ND	ND	ND	NR	NR	ND	NS	NS	ND	ND
	7/18/2002		ND	ND	0.0045	NR	NR	0.011	NS	NS	0.0073	0.0266
	7/23/2003		ND	ND	ND	NR	NR	ND	NS	NS	ND	ND
	12/3/2004		ND	ND	ND	NR	NR	0.0074	NS	NS	0.00091	0.0115
	8/10/2005		0.0037	ND	0.0052	NR	NR	0.0809	NS	NS	0.0115	0.378
	8/30/2006		0.0012	0.009	0.0017	NR	NR	0.00081	0.0014	ND	0.00082	0.0018
	12/18/2007		ND	ND	ND	NR	NR	0.0012	0.0023	ND	0.0042	0.0022
	11/26/2008		0.0021	ND	ND	NR	NR	0.001	ND	ND	0.0069	0.0024
	7/29/2009		ND	ND	ND	NR	NR	ND	ND	ND	ND	ND
	7/22/2011		0.0043	ND	ND	ND	NR	ND	ND	ND	0.0057	ND
	7/26/2012		0.0011J	ND	ND	ND	ND	0.00078 J	ND	ND	0.00081 J	0.0018 J
TZ	7/12/2000	11.0-12.5	ND	ND	3.2	NR	NR	ND	NS	NS	ND	ND
	7/11/2001		**0.156**	ND	ND	NR	NR	0.643	NS	NS	0.308	1.970
	7/18/2002		ND	ND	ND	NR	NR	ND	NS	NS	ND	0.0028
	7/23/2003		**0.0069**	ND	0.0088	NR	NR	0.0445	NS	NS	0.0161	0.17
	12/3/2004		ND	ND	0.00094	NR	NR	0.00062	NS	NS	0.00053	0.0021
	8/10/2005		**0.005**	0.0782	0.0037	NR	NR	0.0432	NS	NS	0.0166	0.179
	8/30/2006		ND	ND	ND	NR	NR	ND	ND	ND	ND	ND
	12/18/2007		ND	ND	ND	NR	NR	0.0021	0.0025	ND	0.0077	0.0051
	11/26/2008		0.0033	ND	ND	NR	NR	ND	ND	ND	0.0068	ND
	7/29/2009		ND	0.0594	ND	NR	NR	ND	ND	ND	ND	ND
	7/22/2011		ND	ND	ND	ND	NR	ND	ND	ND	ND	ND
	7/26/2012		0.00051 J	ND	ND	ND	ND	ND	ND	ND	0.00035 J	0.00031 J
UZ	7/12/2000	10.0-11.0	ND	ND	ND	NR	NR	ND	NS	NS	ND	ND
	7/11/2001		ND	ND	ND	NR	NR	ND	NS	NS	ND	ND
	7/18/2002		ND	ND	ND	NR	NR	ND	NS	NS	ND	ND
	7/23/2003		0.0031	ND	ND	NR	NR	0.0107	NS	NS	0.0043	0.0333
	12/3/2004		ND	ND	0.0014	NR	NR	ND	NS	NS	0.00056	0.002
	8/10/2005		ND	ND	ND	NR	NR	ND	NS	NS	ND	ND
	8/30/2006		ND	ND	ND	NR	NR	ND	ND	ND	ND	ND
	12/18/2007		ND	ND	ND	NR	NR	0.0028	0.0027	ND	0.0087	0.007
	11/26/2008		0.0034	ND	ND	NR	NR	0.0043	0.00055	ND	0.0096	0.0207
	7/29/2009		ND	0.029	ND	NR	NR	ND	ND	ND	ND	ND
	7/22/2011		ND	0.0035	ND	ND	NR	ND	ND	ND	0.00049	ND
	7/26/2012		0.00033 J	ND	ND	ND	0.00038 J	0.00089 J	ND	ND	0.00047 J	0.00096 J

All data reported in mg/kg unless otherwise noted
-- Not Available/ Not Applicable
IGW SSL - Impact to Groundwater Soil Screening Level
ND-Non detect RDCSRS- Residential Direct Contact Soil Remediation Standard
NA- Not Analyzed NRDCSRS- Non Residential Direct Contact Soil Remediation Standard
NR- Not Reported Values in **bold** indicated the value is above the applicable remediation standard
J- Estimate Value (#) - Indicates number of TICs

Table 2b - Soil Data - SVOCs
No. 1 Landfarm Soil Core Monitoring Summary
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Semi-Volatile Organic																						
Sample Location	Sample Date	Approximate Elevation Above Mean Sea Level (feet)	Acenaphthene (CAS # 83-32-9)	Acenaphthylene (CAS # 208-96-8)	Anthracene (CAS # 120-12-7)	Benzo(a)anthracene (CAS # 56-55-3)	Benzo(a)pyrene (CAS # 50-32-8)	Benzo(b)fluoranthene (CAS # 205-99-2)	Benzo(g,h,i)perylene (CAS #191-24-2)	Benzo(k)fluoranthene (CAS # 207-08-9)	Butyl Benzyl Phthalate (CAS # 85-68-7)	Chrysene (CAS # 218-01-9)	Dibenz(a,h)anthracene (CAS # 53-70-8)	bis(2-Ethylhexyl)phthalate (CAS # 117-81-7)	Fluoranthene (CAS # 206-44-0)	Fluorene (CAS # 86-73-7)	Indeno(1,2,3-cd)pyrene (CAS # 193-39-5)	6-MethylChrysene (CAS # 1705-85-7)	Naphthalene (CAS # 91-20-3)	Phenanthrene (CAS # 85-01-8)	Pyrene (CAS # 129-00-0)	Total Semi-Volatile TICs
NRDC SRS			37,000	300,000	30,000	2	0.2	2	30,000	23	14,000	230	0.2	140	24,000	24,000	2	--	17	300,000	18,000	--
RDC SRS			3,400	--	17,000	0.6	0.2	0.6	380,000	6	1,200	62	0.2	35	2,300	2,300	0.6	--	6	--	1,700	--
IGW SSL			110	--	2,400	0.8	0.2	2	--	25	230	80	0.8	1,200	1,300	170	7	--	25	--	840	--
Maximum Concentrationmg/kg			**0.0654**	**0.0769**	**47.6**	**133**	**89.8**	**154**	**0.35**	**116**	**ND**	**269**	**0.403**	**65.7**	**111**	**0.0562**	**0.125**	**4.42**	**2.54**	**142**	**279**	**16.57**
Minimum Concentration			**0.0654**	**0.0439**	**0.0268**	**0.0519**	**0.0616**	**0.016**	**0.112**	**0.035**	**ND**	**0.0798**	**0.0775**	**0.0859**	**0.042**	**0.0562**	**0.046**	**0.067**	**0.04**	**0.0676**	**0.057**	**ND**
Z0I	7/12/2000	13.0-13.5	NR	NR	2.66	**1.15**	**0.711**	ND	NR	ND	ND	2.87	ND	1.26	1.19	NR	NR	NS	ND	22.7	5.23	NR
	7/11/2001		NR	NR	1.94	**3.49**	**3.2**	**2.07**	NR	0.441	ND	7.41	ND	1.25	2.32	NR	NR	2.57	ND	12.4	10.8	NR
	7/18/2002		NR	NR	ND	**1.22**	**1.23**	**0.613**	NR	ND	ND	3	**0.403**	0.973	0.397	NR	NR	ND	0.386	4.45	3.6	NR
	7/23/2003		NR	NR	NS	NS	NS	NS	NR	NS	NS	NS	NS	NS	NS	NR	NR	NS	NS	NS	NS	NR
	12/3/2004		NR	NR	0.391	0.556	**1.2**	0.494	NR	ND	ND	2.45	ND	0.82	0.169	NR	NR	0.833	0.27	1.05	2.27	NR
	8/10/2005		NR	NR	NS	NS	NS	NS	NR	NS	NS	NS	NS	NS	NS	NR	NR	NS	NS	NS	NS	NR
	8/30/2006		NR	NR	NS	NS	NS	NS	NR	NS	NS	NS	NS	NS	NS	NR	NR	NS	NS	NS	NS	NR
	12/18/2007		NR	NR	NS	NS	NS	NS	NR	NS	NS	NS	NS	NS	NS	NR	NR	NS	NS	NS	NS	NR
	11/26/2008		NR	NR	NS	NS	NS	NS	NR	NS	NS	NS	NS	NS	NS	NR	NR	NS	NS	NS	NS	NR
	7/29/2009		NR	NR	0.559	ND	ND	ND	NR	ND	ND	ND	ND	0.432	ND	NR	NR	ND	0.0564	0.211	0.215	NR
	7/22/2011		NR	NR	ND	ND	ND	ND	NR	ND	ND	ND	ND	0.0873	ND	NR	NR	ND	ND	ND	ND	NR
	7/26/2012		ND	0.0769	0.0791	0.0828	**0.353**	0.0160	0.350	0.0524	ND	0.475	0.0775	0.0899	0.0421	0.0208 J	0.125	NA	0.0207 J	0.0676	0.255	13.92 J (15)
TZ	7/12/2000	11.0-12.5	NR	NR	47.6	**133**	**89.8**	**154**	NR	**116**	ND	**269**	ND	**65.7**	111	NR	NR	NS	ND	142	279	NR
	7/11/2001		NR	NR	3.34	**7.02**	**5.71**	**3.65**	NR	0.971	ND	13.4	ND	1.9	4.82	NR	NR	4.42	2.54	24.4	18	NR
	7/18/2002		NR	NR	1.67	**1.88**	**1.88**	**1.65**	NR	0.544	ND	3.15	ND	0.305	2.59	NR	NR	ND	0.373	6.88	5.05	NR
	7/23/2003		NR	NR	NS	NS	NS	NS	NR	NS	NS	NS	NS	NS	NS	NR	NR	NS	NS	NS	NS	NR
	12/3/2004		NR	NR	0.0268	0.0519	0.0616	0.077	NR	0.035	ND	0.124	ND	0.228	0.0587	NR	NR	0.0674	0.0406	0.0777	0.126	NR
	8/10/2005		NR	NR	NS	NS	NS	NS	NR	NS	NS	NS	NS	NS	NS	NR	NR	NS	NS	NS	NS	NR
	8/30/2006		NR	NR	NS	NS	NS	NS	NR	NS	NS	NS	NS	NS	NS	NR	NR	NS	NS	NS	NS	NR
	12/18/2007		NR	NR	NS	NS	NS	NS	NR	NS	NS	NS	NS	NS	NS	NR	NR	NS	NS	NS	NS	NR
	11/26/2008		NR	NR	NS	NS	NS	NS	NR	NS	NS	NS	NS	NS	NS	NR	NR	NS	NS	NS	NS	NR
	7/29/2009		NR	NR	0.396	ND	ND	ND	NR	ND	ND	ND	ND	0.207	0.126	NR	NR	ND	0.0415	0.132	0.274	NR
	7/22/2011		NR	NR	ND	ND	ND	ND	NR	ND	ND	ND	ND	ND	ND	NR	NR	ND	ND	ND	ND	NR
	7/26/2012		0.0373 J	0.0390 J	0.0575	0.168	0.195	0.116	0.112	0.0376J	ND	0.369	0.0350 J	0.0727J	0.0910	ND	0.0457	NA	ND	0.0299 J	0.307	16.57 J (23)
UZ	7/12/2000	10.0-11.0	NR	NR	21.2	**56.7**	**53.2**	ND	NR	ND	ND	**110**	ND	ND	63.2	NR	NR	NS	ND	63.1	156	NR
	7/11/2001		NR	NR	0.48	0.593	**0.567**	0.338	NR	ND	ND	1.46	ND	0.195	0.433	NR	NR	ND	0.18	3.3	1.75	NR
	7/18/2002		NR	NR	ND	ND	ND	0.04	NR	ND	ND	0.0798	ND	ND	ND	NR	NR	ND	ND	ND	0.057	NR
	7/23/2003		NR	NR	NS	NS	NS	NS	NR	NS	NS	NS	NS	NS	NS	NR	NR	NS	NS	NS	NS	NR
	12/3/2004		NR	NR	0.155	0.314	**0.309**	0.262	NR	0.167	ND	0.379	ND	0.117	0.488	NR	NR	0.199	0.0574	0.489	0.597	NR
	8/10/2005		NR	NR	NS	NS	NS	NS	NR	NS	NS	NS	NS	NS	NS	NR	NR	NS	NS	NS	NS	NR
	8/30/2006		NR	NR	NS	NS	NS	NS	NR	NS	NS	NS	NS	NS	NS	NR	NR	NS	NS	NS	NS	NR
	12/18/2007		NR	NR	NS	NS	NS	NS	NR	NS	NS	NS	NS	NS	NS	NR	NR	NS	NS	NS	NS	NR
	11/26/2008		NR	NR	NS	NS	NS	NS	NR	NS	NS	NS	NS	NS	NS	NR	NR	NS	NS	NS	NS	NR
	7/29/2009		NR	NR	0.398	ND	ND	ND	NR	ND	ND	ND	ND	0.22	0.125	NR	NR	ND	0.0399	0.156	0.609	NR
	7/22/2011		NR	NR	ND	ND	ND	ND	NR	ND	ND	ND	ND	ND	ND	NR	NR	ND	ND	ND	ND	NR
	7/26/2012		0.0654	0.0439	0.109	0.238	**0.262**	0.171	0.185	0.0438	ND	0.502	ND	0.0859	0.159	0.0562	0.100	NA	.0129 J	0.122	0.414	15.010 J (22)

All data reported in mg/kg unless otherwise noted
-- Not Available/ Not Applicable
IGW SSL - Impact to Groundwater Soil Screening Level
ND-Non detect RDCSRS- Residential Direct Contact Soil Remediation Standard
NA- Not Analyzed NRDCSRS- Non Residential Direct Contact Soil Remediation Standard
NR- Not Reported Values in **bold** indicated the value is above the applicable remediation standard
J- Estimate Value (#) - Indicates number of TICs

Table 2c - Soil Data - Metals
No. 1 Landfarm Soil Core Monitoring Summary
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Metals														
Sample Location	Sample Date	Approximate Elevation Above Mean Sea Level (feet)	Antimony (CAS # 7440-36-0)	Arsenic (CAS # 7440-38-2)	Barium (CAS # 7440-39-3)	Beryllium (CAS # 7440-41-7)	Cadmium (CAS # 7440-43-9)	Chromium (CAS # 7440-47-3)	Cobalt (CAS # 7440-48-4)	Lead (CAS # 7439-92-1)	Mercury (CAS # 7439-97-6)	Nickel (CAS # 7440-02-0)	Selenium (CAS # 7782-49-2)	Vanadium (CAS # 7440-62-2)
NRDC SRS			450	19	59,000	140	78	--	590	800	65	23,000	5,700	1,100
RDC SRS			31	19	16,000	16	78	--	1,600	400	23	1,600	390	78
IGW SSL			6	19	1,300	0.5	1	20*	90	90	0.1	48	11	--
Maximum Concentration			**5.6**	**53**	**448**	**0.97**	**2.3**	**115**	**17.1**	**202**	**2.5**	**1,280**	**23.4**	**110**
Minimum Concentration			**2.8**	**3.1**	**26.1**	**0.36**	**0.66**	**5.1**	**5.5**	**7.4**	**0.035**	**8**	**1.2**	**11.2**
Z0I	7/12/2000	13.0-13.5	<6.8	16.4	108	**0.62**	<0.57	**59.2**	8.4	**76.1**	**0.29**	**180**	<11	47.4
	7/11/2001		<1.0	14.4	121	<0.51	0.85	**97.7**	10.3	**101**	**0.19**	**366**	2.4	58.7
	7/18/2002		<1.5	**26.4**	139	<0.75	<0.75	**93.2**	12.6	82.9	**0.93**	**765**	6.5	74.6
	7/23/2003		<1.4	**23.9**	143	<0.71	0.82	**61.5**	8.7	**91.1**	**0.63**	**650**	5.9	67.9
	12/3/2004		<1.5	**24.2**	174	<0.76	1.3	**62.6**	9.4	**101**	**1.3**	**817**	9	73
	8/10/2005		<1.2	**22.8**	127	<0.61	<0.61	**66.8**	9.2	89.2	**1.2**	**675**	11	NS
	8/30/2006		<2.2	7.4	48.3	<0.56	<0.56	**68.1**	5.8	46.4	**0.21**	**112**	<2.2	NS
	12/18/2007		<2.8	**28.3**	172	<0.69	1.2	**78.1**	12	**122**	**1.6**	**999**	10.9	NS
	11/26/2008		<3.1	**25**	145	<0.76	<0.76	**68.8**	11.1	**96.8**	**1.2**	**781**	10.7	NS
	7/29/2009		<3.0	**53**	263	<0.75	1.1	**60.8**	10.9	**160**	**2.3**	**1,200**	**17.5**	NS
	7/22/2011		<2.1	9.8	35.1	0.45	<0.53	**24**	<5.3	7.4	0.035	12	<2.1	27.6
	7/26/2012		<2.9	17.5	NA	**0.60**	0.96	**75.7**	NA	**96.0**	**0.44**	**1,140**	5.6	NA
TZ	7/12/2000	11.0-12.5	<6.6	15	80.3	**0.68**	<0.55	**23.7**	6.2	67.6	**0.15**	**79**	<11	48.1
	7/11/2001		2.8	17	155	<0.53	1.3	**115**	15.8	**182**	**0.16**	**295**	2.5	53.8
	7/18/2002		<1.1	11.9	61.8	<0.57	<0.57	**36.6**	6.2	42.3	**0.29**	**198**	1.7	33
	7/23/2003		<2.0	**44.6**	236	<0.99	1.6	**81.2**	12.5	**142**	**2**	**1,190**	**13.7**	**110**
	12/3/2004		<1.1	7	34.2	<0.53	<0.53	**21.7**	5.5	19.7	**0.15**	35	<1.1	21
	8/10/2005		<1.2	18.5	101	<0.60	<0.60	**45.1**	7.5	66.1	**1.3**	**568**	9.9	NS
	8/30/2006		<2.1	<2.1	<21	<0.53	<0.53	5.1	<5.3	8.1	<0.033	<4.2	<2.1	NS
	12/18/2007		<2.9	**31**	195	<0.73	1.4	**84.1**	12.4	**142**	**1.6**	**1,210**	**13.3**	NS
	11/26/2008		<2.8	**27.2**	153	<0.70	<0.70	**75.3**	9.1	**102**	**1**	**820**	10	NS
	7/29/2009		<3.4	**48**	235	<0.84	1.1	**70.8**	12.3	**141**	**2.5**	**1,280**	**18.2**	NS
	7/22/2011		<2.2	7.1	26.9	0.39	<0.54	**16.1**	<5.4	12	0.063	12	<2.2	23.8
	7/26/2012		<3.1	17.1	NA	**0.94**	**2.3**	**88.5**	NA	**116**	**0.28**	**236**	<3.1	NA
UZ	7/12/2000	10.0-11.0	<6.6	6.6	<22	<0.55	<0.55	**28.8**	<5.5	16.8	0.088	26	<11	15.9
	7/11/2001		<1.2	7.6	63.4	<0.59	<0.59	**26.7**	<5.9	35.5	0.066	**59**	1.2	28.9
	7/18/2002		<1.1	3.1	<22	<0.55	<0.55	8.1	<5.5	9.6	0.069	8	<1.1	11.2
	7/23/2003		<1.6	**21.1**	448	<0.79	<0.79	**56.5**	11.9	80.8	**0.89**	**593**	5.7	61.3
	12/3/2004		<1.1	**20.1**	38.4	**0.57**	<0.54	**23.6**	<5.4	36.5	**0.15**	**63**	<1.1	30.8
	8/10/2005		<1.0	7.2	26.1	<0.52	<0.52	13.6	<5.2	14.1	<0.033	11	2.5	NS
	8/30/2006		<2.2	<2.2	<22	<0.55	<0.55	5.8	<5.5	<2.2	<0.033	<4.4	<2.2	NS
	12/18/2007		<2.9	**34.8**	223	**0.97**	1.4	**90.2**	17.1	**202**	**1.4**	**1,200**	**13.7**	NS
	11/26/2008		<2.6	**25.3**	148	<0.64	0.67	**65.2**	9.2	**99.9**	**0.74**	**789**	10.1	NS
	7/29/2009		<6.6	**41.3**	196	<0.82	<1.6	**87.8**	14.2	**167**	**1.8**	**1,190**	**23.4**	NS
	7/22/2011		<2.2	7	86.1	0.36	<0.54	19.4	<5.4	8.8	0.066	13	<2.2	18.6
	7/26/2012		5.6	19.4	NA	**0.85**	0.66	**63.7**	NA	**87.9**	**0.23**	**212**	<2.3	NA

All data reported in mg/kg unless otherwise noted
-- Not Available/ Not Applicable
IGW SSL - Impact to Groundwater Soil Screening Level
ND-Non detect RDCSRS- Residential Direct Contact Soil Remediation Standard
NA- Not Analyzed NRDCSRS- Non Residential Direct Contact Soil Remediation Standard
NR- Not Reported Values in **bold** indicated the value is above the applicable remediation standard
J- Estimate Value (#) - Indicates number of TICs

Table 2d - Soil Data - General Chemistry
No. 1 Landfarm Soil Core Monitoring Summary
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

General Chemistry								
Sample Location	Sample Date	Approximate Elevation Above Mean Sea Level (feet)	**Nitrogen, Total Kjeldahl (CAS # 7727-37-9)**	**Specific Conductivity (unhos/cm)**	**HEM Oil and Grease**	**Solids, Percent**	**Benzenethiol (CAS # 108-98-5)**	**pH (su)**
NRDC SRS			--	--	--	--	--	MIN =
RDC SRS			--	--	--	--	--	**4.72**
IGW SSL			--	--	--	--	--	MAX =
Maximum Concentration			**11,300**	**6,070**	**286,000**	**95**	**2**	**8.88**
Z0I	7/12/2000	13.0-13.5	669	3,390	17,000	88.2	NS	7.3
	7/11/2001		1,790	4,920	30,700	90.6	1.54	6.7
	7/18/2002		5,920	359	17,100	66.6	0.986	7.74
	7/23/2003		5,100	5,920	7,170	70.6	NS	6.3
	12/3/2004		5,520	3,760	16,200	64.8	1.07	7.44
	8/10/2005		5,090	4,600	21,700	81.6	NS	6.34
	8/30/2006		372	1,430	4,510	91.4	NS	7.78
	12/18/2007		6,670	2,290	8,210	69	NS	7.2
	11/26/2008		4,940	2,670	9,340	65.5	NS	6.71
	7/29/2009		9,220	1,090	11,500	65.4	1.56	5.42
	7/22/2011		277	56	<510	94.7	ND	5.36
	7/26/2012		3,710	1,170	11,900	68.1	NA	6.55
TZ	7/12/2000	11.0-12.5	880	2,140	1,580	90.1	NS	7.7
	7/11/2001		3,120	1,870	44,600	88	1.16	7.8
	7/18/2002		1,390	373	7,410	87.2	0.388	7.19
	7/23/2003		11,300	6,070	11,000	49.7	NS	8.6
	12/3/2004		319	1,140	623	91.8	0.0363	8.79
	8/10/2005		2,860	2,540	8,050	85.4	NS	8.18
	8/30/2006		104	839	<570	91	NS	4.72
	12/18/2007		5,670	2,340	7,510	69.5	NS	6.81
	11/26/2008		4,580	3,330	11,500	70.8	NS	6.58
	7/29/2009		7,500	1,400	7,360	59.9	1.22	5.76
	7/22/2011		87.4	1	<530	1.2	ND	6.11
	7/26/2012		1,240	2,220	5,090	66.2	NA	7.06
UZ	7/12/2000	10.0-11.0	305	1,130	1,040	90.6	NS	7.4
	7/11/2001		662	1,620	3,410	84	0.165	6.9
	7/18/2002		117	62	629	91	ND	6.93
	7/23/2003		4,980	3,330	6,120	64.1	NS	7.27
	12/3/2004		414	1,020	1,070	90.6	0.0627	8.88
	8/10/2005		156	603	<530	93.4	NS	8.74
	8/30/2006		38	767	<600	91.1	NS	7.93
	12/18/2007		5,070	2,500	10,500	68.1	NS	6.62
	11/26/2008		3,700	3,050	18,300	77.4	NS	6.86
	7/29/2009		7,460	1,710	9,680	59.1	1.42	5.71
	7/22/2011		117	19.3	286,000	90	ND	5.23
	7/26/2012		471	2,070	3,630	88	NA	7.25

All data reported in mg/kg unless otherwise noted
-- Not Available/ Not Applicable
IGW SSL - Impact to Groundwater Soil Screening Level
ND-Non detect RDCSRS- Residential Direct Contact Soil Remediation Standard
NA- Not Analyzed NRDCSRS- Non Residential Direct Contact Soil Remediation Standard
NR- Not Reported Values in **bold** indicated the value is above the applicable remediation standard
J- Estimate Value (#) - Indicates number of TICs

Table 2e - 2013 Soil Data - Detections - NJDEP HazSite Database
No. 1 Landfarm Soil Core Monitoring Summary
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

SVOCs

SAMPDATE	SAMPNUM	LABID	ANALTPARAM	CAS	CONC	CONCUNITS	QAQUAL	MINIMUM STANDARD	EXCEEDANCE	RATIO
7/24/2013	TZ	JB43132-2	Anthracene	120-12-7	0.07	mg/kg		110	IGW SSL	0.0006
7/24/2013	UZ	JB43132-3	Anthracene	120-12-7	0.04	mg/kg		110	IGW SSL	0.0004
7/24/2013	ZOI	JB43132-1	Anthracene	120-12-7	0.06	mg/kg		110	IGW SSL	0.0005
7/24/2013	UZ	JB43132-3	Benzo(a)anthracene	56-55-3	0.02	mg/kg	J	0.6	RDC SRS	0.03
7/24/2013	ZOI	JB43132-1	Benzo(a)anthracene	56-55-3	0.03	mg/kg	J	0.6	RDC SRS	0.05
7/24/2013	UZ	JB43132-3	Benzo(a)pyrene	50-32-8	0.02	mg/kg	J	0.2	RDC SRS	0.1
7/24/2013	TZ	JB43132-2	Benzo(b)fluoranthene	205-99-2	0.03	mg/kg	J	0.6	RDC SRS	0.05
7/24/2013	UZ	JB43132-3	Benzo(b)fluoranthene	205-99-2	0.03	mg/kg	J	0.6	RDC SRS	0.05
7/24/2013	ZOI	JB43132-1	Benzo(b)fluoranthene	205-99-2	0.02	mg/kg	J	0.6	RDC SRS	0.03
7/24/2013	UZ	JB43132-3	Chrysene	218-01-9	0.03	mg/kg	J	62	RDC SRS	0.0005
7/24/2013	ZOI	JB43132-1	Chrysene	218-01-9	0.04	mg/kg		62	RDC SRS	0.0006
7/24/2013	ZOI	JB43132-1	Dimethyl phthalate	131-11-3	0.18	mg/kg		NA	NA	NA
7/24/2013	TZ	JB43132-2	Fluoranthene	206-44-0	0.02	mg/kg	J	1,300	IGW SSL	0.00002
7/24/2013	UZ	JB43132-3	Fluoranthene	206-44-0	0.02	mg/kg	J	1,300	IGW SSL	0.00002
7/24/2013	TZ	JB43132-2	Naphthalene	91-20-3	0.02	mg/kg	J	6	RDC SRS	0.003333
7/24/2013	ZOI	JB43132-1	Naphthalene	91-20-3	0.03	mg/kg	J	6	RDC SRS	0.00500
7/24/2013	TZ	JB43132-2	Phenanthrene	85-01-8	0.03	mg/kg	J	300,000	NRDC SRS	1E-07
7/24/2013	ZOI	JB43132-1	Phenanthrene	85-01-8	0.02	mg/kg	J	300,000	NRDC SRS	7E-08
7/24/2013	TZ	JB43132-2	Pyrene	129-00-0	0.03	mg/kg	J	840	IGW SSL	0.00004
7/24/2013	UZ	JB43132-3	Pyrene	129-00-0	0.02	mg/kg	J	840	IGW SSL	0.00002
7/24/2013	ZOI	JB43132-1	Pyrene	129-00-0	0.02	mg/kg	J	840	IGW SSL	0.00002

METALS

SAMPDATE	SAMPNUM	LABID	ANALTPARAM	CAS	CONC	CONCUNITS	QAQUAL	MINIMUM STANDARD	EXCEEDANCE	RATIO
7/24/2013	TZ	JB43132-2	Arsenic	7440-38-2	12.1	mg/kg		19	RDC SRS	0.6
7/24/2013	UZ	JB43132-3	Arsenic	7440-38-2	14	mg/kg		19	RDC SRS	0.7
7/24/2013	ZOI	JB43132-1	Arsenic	7440-38-2	10.4	mg/kg		19	RDC SRS	0.5
7/24/2013	TZ	JB43132-2	Barium	7440-39-3	50	mg/kg		1,300	IGW SSL	0.04
7/24/2013	UZ	JB43132-3	Barium	7440-39-3	51.5	mg/kg		1,300	IGW SSL	0.04
7/24/2013	ZOI	JB43132-1	Barium	7440-39-3	42.7	mg/kg		1,300	IGW SSL	0.03
7/24/2013	TZ	JB43132-2	Beryllium	7440-41-7	0.47	mg/kg		0.5	IGW SSL	0.94
7/24/2013	**UZ**	**JB43132-3**	**Beryllium**	**7440-41-7**	**0.56**	**mg/kg**		**0.5**	**IGW SSL**	**1.12**
7/24/2013	ZOI	JB43132-1	Beryllium	7440-41-7	0.43	mg/kg		0.5	IGW SSL	0.86
7/24/2013	**TZ**	**JB43132-2**	**Chromium**	**7440-47-3**	**21.9**	**mg/kg**		**20**	**Cr6+ Screening**	**1.1**
7/24/2013	**UZ**	**JB43132-3**	**Chromium**	**7440-47-3**	**23.8**	**mg/kg**		**20**	**Cr6+ Screening**	**1.2**
7/24/2013	ZOI	JB43132-1	Chromium	7440-47-3	19.5	mg/kg		20	Cr6+ Screening	1
7/24/2013	UZ	JB43132-3	Cobalt	7440-48-4	7.1	mg/kg		90	IGW SSL	0.08
7/24/2013	TZ	JB43132-2	Lead	7439-92-1	33.6	mg/kg		90	IGW SSL	0.4
7/24/2013	UZ	JB43132-3	Lead	7439-92-1	34.8	mg/kg		90	IGW SSL	0.4
7/24/2013	ZOI	JB43132-1	Lead	7439-92-1	30.2	mg/kg		90	IGW SSL	0.3
7/24/2013	TZ	JB43132-2	**Mercury**	**7439-97-6**	**0.19**	**mg/kg**		**0.1**	**IGW SSL**	**1.9**
7/24/2013	UZ	JB43132-3	**Mercury**	**7439-97-6**	**0.19**	**mg/kg**		**0.1**	**IGW SSL**	**1.9**
7/24/2013	ZOI	JB43132-1	Mercury	7439-97-6	0.13	mg/kg		0.1	IGW SSL	1.3
7/24/2013	**TZ**	**JB43132-2**	**Nickel**	**7440-02-0**	**76.7**	**mg/kg**		**48**	**IGW SSL**	**1.6**
7/24/2013	**UZ**	**JB43132-3**	**Nickel**	**7440-02-0**	**70**	**mg/kg**		**48**	**IGW SSL**	**1.5**
7/24/2013	**ZOI**	**JB43132-1**	**Nickel**	**7440-02-0**	**64.8**	**mg/kg**		**48**	**IGW SSL**	**1.4**
7/24/2013	TZ	JB43132-2	Vanadium	7440-62-2	36.4	mg/kg		78	RDC SRS	0.5
7/24/2013	UZ	JB43132-3	Vanadium	7440-62-2	36.8	mg/kg		78	RDC SRS	0.5
7/24/2013	ZOI	JB43132-1	Vanadium	7440-62-2	30.9	mg/kg		78	RDC SRS	0.4

GENERAL CHEMISTRY

SAMPDATE	SAMPNUM	LABID	ANALTPARAM	CAS	CONC	CONCUNITS	QAQUAL	STANDARD	EXCEEDANCE	RATIO
7/24/2013	TZ	JB43132-2	Specific Conductivity	SRP 98	82.2	umhos/cm		NA	NA	NA
7/24/2013	UZ	JB43132-3	Specific Conductivity	SRP 98	94.3	umhos/cm		NA	NA	NA
7/24/2013	ZOI	JB43132-1	Specific Conductivity	SRP 98	85	umhos/cm		NA	NA	NA
7/24/2013	TZ	JB43132-2	pH	SRP 6	6.96	su		6.5-8.5	NA	NA
7/24/2013	UZ	JB43132-3	pH	SRP 6	6.66	su		6.5-8.5	NA	NA
7/24/2013	ZOI	JB43132-1	pH	SRP 6	7.53	su		6.5-8.5	NA	NA
7/24/2013	TZ	JB43132-2	Nitrogen, Total	7727-37-9	498	mg/kg		NA	NA	NA
7/24/2013	UZ	JB43132-3	Nitrogen, Total	7727-37-9	350	mg/kg		NA	NA	NA
7/24/2013	ZOI	JB43132-1	Nitrogen, Total	7727-37-9	497	mg/kg		NA	NA	NA
7/24/2013	TZ	JB43132-2	Nitrogen, Total Kjeldahl	UNK-001454	487	mg/kg		NA	NA	NA
7/24/2013	UZ	JB43132-3	Nitrogen, Total Kjeldahl	UNK-001454	340	mg/kg		NA	NA	NA
7/24/2013	ZOI	JB43132-1	Nitrogen, Total Kjeldahl	UNK-001454	489	mg/kg		NA	NA	NA

Table 2f - 2014 Soil Data - Exceedances - NJDEP HazSite Database
No. 1 Landfarm Soil Core Monitoring Summary
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

SAMPDATE	MATRIX	AOCID	FIELDID	XCOORD	YCOORD	DEPTH_TOP	DEPTH_BOTM	LABID	ANALTPARAM	CAS	CONC	CONCUNITS	MINIMUM STANDARD	STANDARD TYPE	RATIO
Metals															
7/23/2014	SOIL	AOC3	TZ	563664.13	630021.35	1.5	3.0	JB72471-2	Arsenic	7440-38-2	51.3	mg/kg	19	RDC SRS	2.7
7/23/2014	SOIL	AOC3	ZOI	564151.48	629628.14	0.5	1.0	JB72471-1	Arsenic	7440-38-2	58.2	mg/kg	19	RDC SRS	3.1
7/23/2014	SOIL	AOC3	UZ	563664.13	630021.35	3.0	4.0	JB72471-3	Arsenic	7440-38-2	103	mg/kg	19	RDC SRS	5.4
7/23/2014	SOIL	AOC3	UZ	563664.13	630021.35	3.0	4.0	JB72471-3	Nickel	7440-02-0	1950	mg/kg	1600	RDC SRS	1.2
7/23/2014	SOIL	AOC3	ZOI	564151.48	629628.14	0.5	1.0	JB72471-1	Vanadium	7440-62-2	94.8	mg/kg	78	RDC SRS	1.2
7/23/2014	SOIL	AOC3	TZ	563664.13	630021.35	1.5	3.0	JB72471-2	Vanadium	7440-62-2	102	mg/kg	78	RDC SRS	1.3
7/23/2014	SOIL	AOC3	UZ	563664.13	630021.35	3.0	4.0	JB72471-3	Vanadium	7440-62-2	165	mg/kg	78	RDC SRS	2.1
SVOCs															
SAMPDATE	**MATRIX**	**AOCID**	**FIELDID**	**XCOORD**	**YCOORD**	**DEPTH_TOP**	**DEPTH_BOTM**	**LABID**	**ANALTPARAM**	**CAS**	**CONC**	**CONCUNITS**	**MINIMUM STANDARD**	**STANDARD TYPE**	**RATIO**
7/23/2014	SOIL	AOC3	TZ	563664.13	630021.35	1.5	3.0	JB72471-2	Benzo(a)anthracene	56-55-3	0.64	mg/kg	0.6	RDC SRS	1.1
7/23/2014	SOIL	AOC3	ZOI	564151.48	629628.14	0.5	1.0	JB72471-1	Benzo(a)anthracene	56-55-3	0.76	mg/kg	0.6	RDC SRS	1.3
7/23/2014	SOIL	AOC3	UZ	563664.13	630021.35	3.0	4.0	JB72471-3	Benzo(a)anthracene	56-55-3	1.2	mg/kg	0.6	RDC SRS	2.0
7/23/2014	SOIL	AOC3	ZOI	564151.48	629628.14	0.5	1.0	JB72471-1	Benzo(a)pyrene	50-32-8	2.2	mg/kg	0.2	RDC SRS	11.0
7/23/2014	SOIL	AOC3	TZ	563664.13	630021.35	1.5	3.0	JB72471-2	Benzo(a)pyrene	50-32-8	2.8	mg/kg	0.2	RDC SRS	14.0
7/23/2014	SOIL	AOC3	UZ	563664.13	630021.35	3.0	4.0	JB72471-3	Benzo(a)pyrene	50-32-8	3.4	mg/kg	0.2	RDC SRS	17.0
7/23/2014	SOIL	AOC3	ZOI	564151.48	629628.14	0.5	1.0	JB72471-1	Benzo(b)fluoranthene	205-99-2	1	mg/kg	0.6	RDC SRS	1.7
7/23/2014	SOIL	AOC3	TZ	563664.13	630021.35	1.5	3.0	JB72471-2	Benzo(b)fluoranthene	205-99-2	1.3	mg/kg	0.6	RDC SRS	2.2
7/23/2014	SOIL	AOC3	UZ	563664.13	630021.35	3.0	4.0	JB72471-3	Benzo(b)fluoranthene	205-99-2	2.1	mg/kg	0.6	RDC SRS	3.5
7/23/2014	SOIL	AOC3	ZOI	564151.48	629628.14	0.5	1.0	JB72471-1	Dibenzo(a,h)anthracene	53-70-3	0.6	mg/kg	0.2	RDC SRS	3.0
7/23/2014	SOIL	AOC3	TZ	563664.13	630021.35	1.5	3.0	JB72471-2	Dibenzo(a,h)anthracene	53-70-3	1.1	mg/kg	0.2	RDC SRS	5.5

Table 2g
Hess Corporation - Port Reading Complex (HC-PR)
Soil Analytical Results - No. 1 Landfarm

Client Sample ID:		**NJ Non-Residential Direct Contact Soil**	**NJ Residential Direct Contact Soil**	**NJ Default Impact to Groundwater Soil Screening**	**ZOI**	**TZ**	**VZ**
Lab Sample ID:					**JC706-1**	**JC706-2**	**JC706-3**
Date Sampled:					**8/4/2015**	**8/4/2015**	**8/4/2015**
Matrix:					**Soil**	**Soil**	**Soil**
GC/MS Volatiles (SW846 8260C)							
Benzene	mg/kg	5	2	0.005	0.00095	0.00048 J	ND (0.0092)
2-Butanone (MEK)	mg/kg	44000	3100	0.9	ND (0.0025)	ND (0.0019)	ND (0.13)
Carbon disulfide	mg/kg	110000	7800	6	0.0032	0.00096 J	ND (0.016)
Chlorobenzene	mg/kg	7400	510	0.6	ND (0.00020)	ND (0.00016)	ND (0.011)
Chloroform	mg/kg	2	0.6	0.4	ND (0.00019)	ND (0.00015)	ND (0.010)
1,2-Dibromoethane	mg/kg	0.04	0.008	0.005	ND (0.00017)	ND (0.00013)	ND (0.0090)
1,2-Dichloroethane	mg/kg	3	0.9	0.005	ND (0.00017)	ND (0.00014)	ND (0.0092)
1,4-Dioxane	mg/kg	-	-	-	ND (0.020)	ND (0.016)	ND (1.1)
Ethylbenzene	mg/kg	110000	7800	13	0.0043	0.00048 J	0.0197 J
Methyl Tert Butyl Ether	mg/kg	320	110	0.2	ND (0.00020)	ND (0.00016)	ND (0.011)
Styrene	mg/kg	260	90	3	ND (0.00023)	ND (0.00018)	ND (0.012)
Tert Butyl Alcohol	mg/kg	11000	1400	0.3	ND (0.0034)	ND (0.0027)	ND (0.18)
Toluene	mg/kg	91000	6300	7	ND (0.00027)	0.00099 J	0.0365 J
Vinyl chloride	mg/kg	2	0.7	0.005	ND (0.00025)	ND (0.00020)	ND (0.014)
Xylene (total)	mg/kg	170000	12000	19	0.0097	0.0012	0.0287 J
General Chemistry							
Solids, Percent	%	-	-	-	88.1	89.7	84.1

Table 2g
Hess Corporation - Port Reading Complex (HC-PR)
Soil Analytical Results - No. 1 Landfarm

Client Sample ID:		NJ Non-Residential Direct Contact Soil	NJ Residential Direct Contact Soil	NJ Default Impact to Groundwater Soil Screening	Z0I	TZ	UZ
Lab Sample ID:					JC608-1	JC608-2	JC608-3
Date Sampled:					7/31/2015	7/31/2015	7/31/2015
Matrix:					Soil	Soil	Soil
GC/MS Semi-volatiles (SW846 8270D)							
Benzenethiol	mg/kg	-	-	-	0.627 J	0.0537 J	ND (0.78)
2,4-Dimethylphenol	mg/kg	14000	1200	1	ND (0.18)	ND (0.076)	ND (0.085)
2,4-Dinitrophenol	mg/kg	1400	120	0.3	ND (0.34)	ND (0.15)	ND (0.16)
2-Methylphenol	mg/kg	3400	310	NA	ND (0.11)	ND (0.046)	ND (0.051)
3&4-Methylphenol	mg/kg	-	-	-	ND (0.090)	ND (0.039)	ND (0.043)
4-Nitrophenol	mg/kg	-	-	-	ND (0.25)	ND (0.11)	ND (0.12)
Phenol	mg/kg	210000	18000	8	ND (0.052)	ND (0.023)	ND (0.025)
Anthracene	mg/kg	30000	17000	2400	0.269	0.746	0.0985
Benzo(a)anthracene	mg/kg	2	0.6	0.8	0.156	0.157	0.0299 J
Benzo(a)pyrene	mg/kg	0.2	0.2	0.2	**0.277**	0.0696	ND (0.0094)
Benzo(b)fluoranthene	mg/kg	2	0.6	2	0.151	0.0732	ND (0.0077)
Benzo(k)fluoranthene	mg/kg	23	6	25	0.0453 J	0.0223 J	ND (0.012)
Butyl benzyl phthalate	mg/kg	14000	1200	230	ND (0.032)	ND (0.014)	ND (0.015)
Chrysene	mg/kg	230	62	80	0.36	0.357	0.0545
1,2-Dichlorobenzene	mg/kg	59000	5300	17	ND (0.027)	ND (0.012)	ND (0.013)
1,3-Dichlorobenzene	mg/kg	59000	5300	19	ND (0.025)	ND (0.011)	ND (0.012)
1,4-Dichlorobenzene	mg/kg	13	5	2	ND (0.023)	ND (0.010)	ND (0.011)
7,12-Dimethylbenz(a)anthracene	mg/kg	-	-	-	0.757	ND (0.0099)	ND (0.011)
Dibenz(a,h)acridine	mg/kg	-	-	-	ND (0.40)	ND (0.18)	ND (0.20)
Dibenzo(a,h)anthracene	mg/kg	0.2	0.2	0.8	0.185	0.0315 J	ND (0.0094)
Di-n-butyl phthalate	mg/kg	68000	6100	760	ND (0.022)	ND (0.0094)	ND (0.010)
Di-n-octyl phthalate	mg/kg	27000	2400	3300	ND (0.020)	ND (0.0087)	ND (0.0097)
Diethyl phthalate	mg/kg	550000	49000	88	ND (0.019)	ND (0.0084)	ND (0.0094)
Dimethyl phthalate	mg/kg	-	-	-	ND (0.016)	ND (0.0070)	ND (0.0079)
bis(2-Ethylhexyl)phthalate	mg/kg	140	35	1200	0.108 J	0.0551 J	0.0475 J
Fluoranthene	mg/kg	24000	2300	1300	0.0632 J	0.282	0.0451
Indene	mg/kg	-	-	-	0.0641 J	ND (0.0073)	ND (0.0081)
1-Methylnaphthalene	mg/kg	-	-	-	0.0588 J	0.0410 J	ND (0.0066)
6-Methyl Chrysene	mg/kg	-	-	-	0.243 J	0.0810 J	0.0283 J
Naphthalene	mg/kg	17	6	25	0.0336 J	ND (0.0052)	ND (0.0058)
Phenanthrene	mg/kg	300000	NA	NA	0.152	2.28	0.1
Pyrene	mg/kg	18000	1700	840	0.266	1.3	0.212
Pyridine	mg/kg	-	-	-	ND (0.040)	ND (0.017)	ND (0.019)
Quinoline	mg/kg	-	-	-	ND (0.026)	ND (0.011)	ND (0.013)
Metals Analysis							
Antimony	mg/kg	450	31	6	<2.6	<2.2	<2.5
Arsenic	mg/kg	19	19	19	**39.4**	8.7	4.9
Barium	mg/kg	59000	16000	2100	175	39.9	33.4
Beryllium	mg/kg	140	16	0.7	0.62	0.3	0.48
Cadmium	mg/kg	78	78	2	1.4	<0.56	<0.62
Chromium	mg/kg	-	-	-	91	21.2	18.3
Cobalt	mg/kg	590	1600	90	14.5	<5.6	<6.2
Lead	mg/kg	800	400	90	**136**	25	15.6
Mercury	mg/kg	65	23	0.1	**1.2**	**0.2**	**0.13**
Nickel	mg/kg	23000	1600	48	**1030**	**61.7**	25
Selenium	mg/kg	5700	390	11	6.8	<2.2	<2.5
Vanadium	mg/kg	1100	78	NA	**88.6**	24.5	21.9
General Chemistry							
HEM Oil and Grease	mg/kg	-	-	-	19100	2440	1060
Nitrogen, Nitrate + Nitrite	mg/kg	-	-	-	<25	<22	<24
Nitrogen, Total	mg/kg	-	-	-	3570 [a]	470 [a]	285 [a]
Nitrogen, Total Kjeldahl	mg/kg	-	-	-	3570	470	285
Solids, Percent	%	-	-	-	80	91.7	81.7
Specific Conductivity	umhos/cm	-	-	-	244	448	680
pH	su	-	-	-	6.32	5.62	4.85
Footnotes:							
[a] Calculated as: (Nitrogen, Total Kjeldahl) + (Nitrogen, Nitrate + Nitrite)							

Table 2h
Hess Corporation - Former Port Reading Complex - 750 Cliff Road, Port Reading, New Jersey
No.1 Landfarm - Soil Analytical Results

				SAMPLE ID:	Z01 (0.5-1.0)				TZ (1.5-3.0)				US (3.0-4.0)			
				LAB ID:	L1622745-01				L1622745-02				L1622745-03			
				COLLECTION DATE:	7/21/2016				7/21/2016				7/21/2016			
				SAMPLE DEPTH:												
				SAMPLE MATRIX:	SOIL				SOIL				SOIL			
		NJ-IGWS	NJ-NRDCSRS	NJ-RDCSRS												
ANALYTE	CAS	(mg/kg)	(mg/kg)	(mg/kg)	Conc	Q	RL	MDL	Conc	Q	RL	MDL	Conc	Q	RL	MDL
VOLATILE ORGANICS BY GC/MS-5035																
1,2-Dibromo-3-chloropropane	96-12-8	0.005	0.2	0.08	ND		0.0078	0.001	ND		0.0068	0.0009	ND		0.23	0.03
1,4-Dioxane	123-91-1	NA	NA	NA	ND		0.26	0.038	ND		0.23	0.033	ND		7.6	1.1
1,2-Dibromoethane	106-93-4	0.005	0.04	0.008	ND		0.0078	0.00046	ND		0.0068	0.0004	ND		0.23	0.013
Methylene chloride	75-09-2	0.01	97	34	ND		0.013	0.0029	ND		0.011	0.0025	ND		0.38	0.084
1,1-Dichloroethane	75-34-3	0.2	24	8	ND		0.0039	0.00022	ND		0.0034	0.0002	ND		0.11	0.0065
Chloroform	67-66-3	0.4	2	0.6	ND		0.0039	0.00097	ND		0.0034	0.00084	ND		0.11	0.028
Carbon tetrachloride	56-23-5	0.005	2	0.6	ND		0.0026	0.00055	ND		0.0023	0.00048	ND		0.076	0.016
1,2-Dichloropropane	78-87-5	0.005	5	2	ND		0.0092	0.0006	ND		0.008	0.00052	ND		0.26	0.017
Dibromochloromethane	124-48-1	0.005	8	3	ND		0.0026	0.0004	ND		0.0023	0.00035	ND		0.076	0.012
1,1,2-Trichloroethane	79-00-5	0.02	6	2	ND		0.0039	0.0008	ND		0.0034	0.00069	ND		0.11	0.023
Tetrachloroethene	127-18-4	0.005	5	2	ND		0.0026	0.00037	ND		0.0023	0.00032	ND		0.076	0.011
Chlorobenzene	108-90-7	0.6	7400	510	ND		0.0026	0.00091	ND		0.0023	0.00079	ND		0.076	0.026
Trichlorofluoromethane	75-69-4	34	340000	23000	ND		0.013	0.001	ND		0.011	0.00088	ND		0.38	0.029
1,2-Dichloroethane	107-06-2	0.005	3	0.9	ND		0.0026	0.0003	ND		0.0023	0.00026	ND		0.076	0.0086
1,1,1-Trichloroethane	71-55-6	0.3	4200	290	ND		0.0026	0.00029	ND		0.0023	0.00025	ND		0.076	0.0084
Bromodichloromethane	75-27-4	0.005	3	1	ND		0.0026	0.00045	ND		0.0023	0.0004	ND		0.076	0.013
trans-1,3-Dichloropropene	10061-02-6	0.005	7	2	ND		0.0026	0.00032	ND		0.0023	0.00028	ND		0.076	0.0092
cis-1,3-Dichloropropene	10061-01-5	0.005	7	2	ND		0.0026	0.00031	ND		0.0023	0.00027	ND		0.076	0.0089
1,3-Dichloropropene, Total	542-75-6	0.005	NA	NA	ND		0.0026	0.00031	ND		0.0023	0.00027	ND		0.076	0.0089
Bromoform	75-25-2	0.03	280	81	ND		0.01	0.00062	ND		0.0091	0.00054	ND		0.3	0.018
1,1,2,2-Tetrachloroethane	79-34-5	0.007	3	1	ND		0.0026	0.00026	ND		0.0023	0.00023	ND		0.076	0.0076
Benzene	71-43-2	0.005	5	2	ND		0.0026	0.00031	ND		0.0023	0.00027	0.028	J	0.076	0.009
Toluene	108-88-3	7	91000	6300	0.0066		0.0039	0.00051	0.011		0.0034	0.00044	0.07	J	0.11	0.015
Ethylbenzene	100-41-4	13	110000	7800	ND		0.0026	0.00033	ND		0.0023	0.00029	0.3		0.076	0.0097
Chloromethane	74-87-3	NA	12	4	ND		0.013	0.00077	ND		0.011	0.00067	0.023	J	0.38	0.022
Bromomethane	74-83-9	0.04	59	25	ND		0.0052	0.00088	ND		0.0046	0.00077	ND		0.15	0.026
Vinyl chloride	75-01-4	0.005	2	0.7	ND		0.0052	0.00031	ND		0.0046	0.00027	ND		0.15	0.0089
Chloroethane	75-00-3	NA	1100	220	ND		0.0052	0.00083	ND		0.0046	0.00072	ND		0.15	0.024
1,1-Dichloroethene	75-35-4	0.008	150	11	ND		0.0026	0.00068	ND		0.0023	0.0006	ND		0.076	0.02
trans-1,2-Dichloroethene	156-60-5	0.6	720	300	ND		0.0039	0.00055	ND		0.0034	0.00048	ND		0.11	0.016
Trichloroethene	79-01-6	0.01	20	7	ND		0.0026	0.00033	ND		0.0023	0.00028	ND		0.076	0.0095
1,2-Dichlorobenzene	95-50-1	17	59000	5300	ND		0.013	0.0004	ND		0.011	0.00035	ND		0.38	0.012
1,3-Dichlorobenzene	541-73-1	19	59000	5300	ND		0.013	0.00035	ND		0.011	0.00031	ND		0.38	0.01
1,4-Dichlorobenzene	106-46-7	2	13	5	ND		0.013	0.00036	ND		0.011	0.00032	ND		0.38	0.01
Methyl tert butyl ether	1634-04-4	0.2	320	110	ND		0.0052	0.00022	ND		0.0046	0.00019	ND		0.15	0.0064
p/m-Xylene	179601-23-1	19	170000	12000	ND		0.0052	0.00052	ND		0.0046	0.00045	0.22		0.15	0.015
o-Xylene	95-47-6	19	170000	12000	ND		0.0052	0.00045	0.0064		0.0046	0.00039	0.54		0.15	0.013
Xylene (Total)	1330-20-7	19	170000	12000	ND		0.0052	0.00045	0.0064		0.0046	0.00039	0.76		0.15	0.013
cis-1,2-Dichloroethene	156-59-2	0.3	560	230	ND		0.0026	0.00037	ND		0.0023	0.00033	ND		0.076	0.011
1,2-Dichloroethene (total)	540-59-0	NA	NA	NA	ND		0.0026	0.00037	ND		0.0023	0.00033	ND		0.076	0.011
Styrene	100-42-5	3	260	90	ND		0.0052	0.001	ND		0.0046	0.00092	ND		0.15	0.03
Dichlorodifluoromethane	75-71-8	39	230000	490	ND		0.026	0.0005	ND		0.023	0.00044	ND		0.76	0.014
Acetone	67-64-1	19	NA	70000	0.12		0.094	0.0027	0.37		0.082	0.0024	0.53	J	2.7	0.079
Carbon disulfide	75-15-0	6	110000	7800	ND		0.026	0.0029	ND		0.023	0.0025	0.093	J	0.76	0.084
2-Butanone	78-93-3	0.9	44000	3100	ND		0.026	0.00071	ND		0.023	0.00062	ND		0.76	0.021
4-Methyl-2-pentanone	108-10-1	NA	NA	NA	ND		0.026	0.00064	ND		0.023	0.00056	ND		0.76	0.018
2-Hexanone	591-78-6	NA	NA	NA	ND		0.026	0.0017	ND		0.023	0.0015	ND		0.76	0.05
Bromochloromethane	74-97-5	NA	NA	NA	ND		0.013	0.00072	ND		0.011	0.00063	ND		0.38	0.021
Isopropylbenzene	98-82-8	NA	NA	NA	ND		0.0026	0.00027	0.0012	J	0.0023	0.00024	0.34		0.076	0.0079
1,2,3-Trichlorobenzene	87-61-6	NA	NA	NA	ND		0.013	0.00039	ND		0.011	0.00034	ND		0.38	0.011
1,2,4-Trichlorobenzene	120-82-1	0.7	820	73	ND		0.013	0.00048	ND		0.011	0.00042	ND		0.38	0.014
Methyl Acetate	79-20-9	22	NA	78000	ND		0.01	0.00071	ND		0.0091	0.00062	5.2		0.3	0.02
Cyclohexane	110-82-7	NA	NA	NA	ND		0.052	0.00038	0.00086	J	0.046	0.00033	0.1	J	1.5	0.011
Methyl cyclohexane	108-87-2	NA	NA	NA	ND		0.01	0.0004	0.0027	J	0.0091	0.00035	0.48		0.3	0.012
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	NA	NA	NA	ND		0.052	0.00072	ND		0.046	0.00062	ND		1.5	0.021
Total VOCs					0.1266	-	-	-	0.39856	-	-	-	8.684	-	-	-
VOLATILE ORGANICS BY GC/MS-5035-TIC																
Unknown		NA	NA	NA	0.0054	J	0	0	-	-	-	-	-	-	-	-
Unknown Benzene		NA	NA	NA	-		-	-	0.02	J	0	0	-	-	-	-
2,4-Dimethylstyrene	2234-20-0	NA	NA	NA	-		-	-	0.032	J	0	0	-	-	-	-
Unknown		NA	NA	NA	-		-	-	0.021	J	0	0	-	-	-	-
Naphthalene	91-20-3	NA	NA	NA	-		-	-	0.051	J	0	0	4.42	J	0	0
Naphthalene	000091-20-3	NA	NA	NA												
Unknown Aromatic		NA	NA	NA	-		-	-	0.028	J	0	0	2.96	J	0	0
Unknown Aromatic		NA	NA	NA	-		-	-	-		-	-	2.62	J	0	0
Unknown Aromatic		NA	NA	NA	-		-	-	0.022	J	0	0	3.14	J	0	0
Unknown Benzene		NA	NA	NA	-		-	-	0.024	J	0	0	4.02	J	0	0
Unknown Aromatic		NA	NA	NA	-		-	-	-		-	-	3.79	J	0	0
Unknown Aromatic		NA	NA	NA	-		-	-	-		-	-	2.61	J	0	0
Unknown Aromatic		NA	NA	NA	-		-	-	0.039	J	0	0	2.65	J	0	0
Unknown		NA	NA	NA	-		-	-	0.039	J	0	0	3.59	J	0	0
Unknown Benzene		NA	NA	NA	-		-	-	0.052	J	0	0	3.72	J	0	0
Unknown		NA	NA	NA	-		-	-	0.024	J	0	0	4.78	J	0	0
Unknown		NA	NA	NA	-		-	-	0.024	J	0	0	2.72	J	0	0
Unknown Benzene		NA	NA	NA	-		-	-	0.02	J	0	0	3.12	J	0	0
Unknown Naphthalene		NA	NA	NA	-		-	-	0.026	J	0	0	4.44	J	0	0
Unknown Benzene		NA	NA	NA	-		-	-	0.032	J	0	0	3.86	J	0	0
Total TIC Compounds		NA	NA	NA	0.0054	J	0	0	0.454	J	0	0	52.44	J	0	0
BASE/NEUTRAL EXTRACTABLES BY GC/MS- WESTBOROUGH LAB																
Acenaphthene	83-32-9	110	37000	3400	ND		1.7	0.17	0.72	J	3.2	0.34	2.3	J	3	0.31
2-Chloronaphthalene	91-58-7	NA	NA	NA	ND		2.1	0.2	ND		4	0.38	ND		3.7	0.35
Hexachlorobenzene	118-74-1	0.2	1	0.3	ND		0.6	0.2	ND		1.2	0.38	ND		1.1	0.35
Bis(2-chloroethyl)ether	111-44-4	0.2	2	0.4	ND		0.75	0.25	ND		1.4	0.48	ND		1.3	0.45
3,3'-Dichlorobenzidine	91-94-1	0.2	4	1	ND		1.6	0.53	ND		3.1	1	ND		2.8	0.95
2,4-Dinitrotoluene	121-14-2	NA	3	0.7	ND		1	0.34	ND		2	0.67	ND		1.8	0.62
2,6-Dinitrotoluene	606-20-2	NA	3	0.7	ND		0.82	0.27	ND		1.6	0.53	ND		1.5	0.49
Fluoranthene	206-44-0	1300	24000	2300	ND		1.2	0.24	1.2	J	2.4	0.46	2.9		2.2	0.43
4-Chlorophenyl phenyl ether	7005-72-3	NA	NA	NA	ND		2.1	0.17	ND		4	0.34	ND		3.7	0.31
Bis(2-chloroisopropyl)ether	108-60-1	5	67	23	ND		2.5	0.24	ND		4.8	0.46	ND		4.5	0.43
Bis(2-chloroethoxy)methane	111-91-1	NA	NA	NA	ND		2.2	0.2	ND		4.4	0.38	ND		4	0.35
Hexachlorobutadiene	87-68-3	0.9	25	6	ND		0.77	0.26	ND		1.5	0.5	ND		1.4	0.46
Hexachlorocyclopentadiene	77-47-4	320	110	45	ND		5.9	1.3	ND		12	2.6	ND		11	2.4
Hexachloroethane	67-72-1	0.2	140	35	ND		1	0.34	ND		2	0.65	ND		1.8	0.6
Isophorone	78-59-1	0.2	2000	510	ND		0.7	0.23	ND		1.4	0.45	ND		1.2	0.42
Naphthalene	91-20-3	25	17	6	0.46	J	2.1	0.25	1.2	J	4	0.49	2.4	J	3.7	0.45
Nitrobenzene	98-95-3	0.2	340	31	ND		0.92	0.31	ND		1.8	0.6	ND		1.6	0.55
NDPA/DPA	86-30-6	0.4	390	99	ND		0.51	0.17	ND		0.99	0.33	ND		0.92	0.3
n-Nitrosodi-n-propylamine	621-64-7	0.2	0.3	0.2	ND		0.52	0.17	ND		1	0.34	ND		0.94	0.31
Bis(2-ethylhexyl)phthalate	117-81-7	1200	140	35	ND		2.1	0.22	0.6	J	4	0.42	1	J	3.7	0.39
Butyl benzyl phthalate	85-68-7	230	14000	1200	ND		2.1	0.28	ND		4	0.54	ND		3.7	0.5
Di-n-butylphthalate	84-74-2	760	68000	6100	ND		2.1	0.18	ND		4	0.36	ND		3.7	0.33
Di-n-octylphthalate	117-84-0	3300	27000	2400	ND		2.1	0.65	ND		4	1.3	ND		3.7	1.2
Diethyl phthalate	84-66-2	88	550000	49000	ND		2.1	0.19	ND		4	0.37	ND		3.7	0.34
Dimethyl phthalate	131-11-3	NA	NA	NA	ND		2.1	0.2	ND		4	0.39	ND		3.7	0.36
Benzo(a)anthracene	56-55-3	0.8	2	0.6	0.3	J	0.7	0.23	1.5		1.4	0.45	3.7		1.2	0.42
Benzo(a)pyrene	50-32-8	0.2	0.2	0.2	ND		1.5	0.51	1.8	J	3	0.98	3.1		2.7	0.91
Benzo(b)fluoranthene	205-99-2	2	2	0.6	0.53		0.52	0.17	1.6		1	0.34	2.7		0.94	0.31
Benzo(k)fluoranthene	207-08-9	25	23	6	ND		0.44	0.14	0.36	J	0.85	0.28	0.58	J	0.78	0.26
Chrysene	218-01-9	80	230	62	0.65	J	1.2	0.21	2.4		2.4	0.42	7.2		2.2	0.38
Acenaphthylene	208-96-8	NA	300000	NA	0.42	J	1.7	0.23	0.98	J	3.2	0.45	1.4	J	3	0.42
Anthracene	120-12-7	2400	30000	17000	0.42	J	1.2	0.18	1.4	J	2.4	0.36	2.8		2.2	0.33
Benzo(ghi)perylene	191-24-2	NA	30000	380000	2		1.7	0.24	2.4	J	3.2	0.48	2.3	J	3	0.44
Fluorene	86-73-7	170	24000	2300	ND		2.1	0.2	1.1	J	4	0.39	3.6	J	3.7	0.36
Phenanthrene	85-01-8	NA	300000	NA	0.83	J	1.2	0.15	4.3		2.4	0.29	12		2.2	0.27
Dibenzo(a,h)anthracene	53-70-3	0.8	0.2	0.2	0.92		0.72	0.24	1.7		1.4	0.47	1.8		1.3	0.43
Indeno(1,2,3-cd)pyrene	193-39-5	7	2	0.6	1.2		0.87	0.29	2.2		1.7	0.56	2.3		1.6	0.52
Pyrene	129-00-0	840	18000	1700	0.48	J	1.2	0.18	4		2.4	0.35	9.8		2.2	0.32
4-Chloroaniline	106-47-8	NA	NA	NA	ND		2.1	0.24	ND		4	0.46	ND		3.7	0.43
2-Nitroaniline	88-74-4	NA	23000	39	ND		2.1	0.38	ND		4	0.74	ND		3.7	0.68
3-Nitroaniline	99-09-2	NA	NA	NA	ND		2.1	0.39	ND		4	0.76	ND		3.7	0.7
4-Nitroaniline	100-01-6	NA	NA	NA	ND		2.1	0.86	ND		4	1.7	ND		3.7	1.5
Dibenzofuran	132-64-9	NA	NA	NA	ND		2.1	0.18	ND		4	0.36	0.73	J	3.7	0.33
2-Methylnaphthalene	91-57-6	8	2400	230	1.3	J	2.5	0.22	2.1	J	4.8	0.43	3.3	J	4.5	0.39
Carbazole	86-74-8	NA	96	24	ND		2.1	0.13	ND		4	0.26	0.46	J	3.7	0.24
4-Bromophenyl phenyl ether	101-55-3	NA	NA	NA	ND		2.1	0.23	ND		4	0.45	ND		3.7	0.41
Benzaldehyde	100-52-7	NA	68000	6100	ND		2.7	0.32	ND		5.3	0.63	ND		4.9	0.58
Caprolactam	105-60-2	12	340000	31000	ND		2.1	0.44	ND		4	0.86	ND		3.7	0.8
Acetophenone	98-86-2	3	5	2	ND		2.1	0.22	ND		4	0.42	1.1	J	3.7	0.39
Biphenyl	92-52-4	140	34000	3100	ND		4.7	0.48	ND		9.2	0.94	ND		8.5	0.86
1,2,4,5-Tetrachlorobenzene	95-94-3	NA	NA	NA	ND		2.1	0.22	ND		4	0.42	ND		3.7	0.39
Atrazine	1912-24-9	0.2	2400	210	ND		1.7	0.73	ND		3.2	1.4	ND		3	1.3
BASE/NEUTRAL EXTRACTABLES BY GC/MS- WESTBOROUGH LAB-TIC																
Unknown Aromatic		NA	NA	NA	-		-	-	-		-	-	24.8	J	0	0
Unknown Aromatic		NA	NA	NA	-		-	-	-		-	-	11.8	J	0	0
Unknown Naphthalene		NA	NA	NA	-		-	-	-		-	-	11.6	J	0	0
Unknown		NA	NA	NA	-		-	-	-		-	-	13.6	J	0	0
Unknown		NA	NA	NA	-		-	-	-		-	-	20.2	J	0	0
Unknown Aromatic		NA	NA	NA	-		-	-	3.73	J	0	0	13	J	0	0
Unknown		NA	NA	NA	-		-	-	-		-	-	16.1	J	0	0
Unknown		NA	NA	NA	-		-	-	-		-	-	11.8	J	0	0
Unknown		NA	NA	NA	-		-	-	4.41	J	0	0	-	-	-	-
Unknown		NA	NA	NA	-		-	-	-		-	-	12	J	0	0
Unknown		NA	NA	NA	-		-	-	-		-	-	15.4	J	0	0
Unknown Alkane		NA	NA	NA	-		-	-	-		-	-	29.6	J	0	0
Unknown Naphthalene		NA	NA	NA	-		-	-	-		-	-	15.6	J	0	0
Unknown		NA	NA	NA	-		-	-	-		-	-	11.8	J	0	0
Unknown Aromatic		NA	NA	NA	-		-	-	3.94	J	0	0	16.7	J	0	0
No Tentatively Identified Compounds		NA	NA	NA	ND		0	0	-	-	-	-	-	-	-	-
Unknown		NA	NA	NA	-		-	-	-		-	-	36.7	J	0	0
Unknown Benzene		NA	NA	NA	-		-	-	3.38	J	0	0	-	-	-	-
Total TIC Compounds		NA	NA	NA	-		-	-	15.5	J	0	0	261	J	0	0
TOTAL METALS																
Aluminum, Total	7429-90-5	6000	NA	78000	22000		9.8	1.9	19000		9.7	1.9	8500		9.1	1.8
Antimony, Total	7440-36-0	6	450	31	ND		4.9	0.78	1.4	J	4.9	0.78	2.5	J	4.5	0.72
Arsenic, Total	7440-38-2	19	19	19	48		0.98	0.32	35		0.97	0.32	17		0.91	0.3
Barium, Total	7440-39-3	2100	59000	16000	180		0.98	0.26	160		0.97	0.26	100		0.91	0.24
Beryllium, Total	7440-41-7	0.7	140	16	0.4	J	0.49	0.11	1		0.49	0.11	0.34	J	0.45	0.1
Cadmium, Total	7440-43-9	2	78	78	1.3		0.98	0.07	1.4		0.97	0.07	0.75	J	0.91	0.06
Calcium, Total	7440-70-2	NA	NA	NA	3000		9.8	2.7	3100		9.7	2.7	3400		9.1	2.5
Chromium, Total	7440-47-3	NA	NA	NA	58		0.98	0.17	83		0.97	0.16	87		0.91	0.15
Cobalt, Total	7440-48-4	90	590	1600	9.9		2	0.48	13		1.9	0.48	9.7		1.8	0.44
Copper, Total	7440-50-8	11000	45000	3100	300		0.98	0.18	340		0.97	0.18	140		0.91	0.16
Iron, Total	7439-89-6	NA	NA	NA	19000		4.9	1.5	30000		4.9	1.5	26000		4.5	1.4
Lead, Total	7439-92-1	90	800	400	120		4.9	0.22	160		4.9	0.21	130		4.5	0.2
Magnesium, Total	7439-95-4	NA	NA	NA	2400		9.8	1.3	2500		9.7	1.3	1800		9.1	1.2
Manganese, Total	7439-96-5	65	5900	11000	130		0.98	0.24	170		0.97	0.23	180		0.91	0.22
Mercury, Total	7439-97-6	0.1	65	23	2.2		0.08	0.02	1.9		0.08	0.02	0.83		0.08	0.02
Nickel, Total	7440-02-0	48	23000	1600	1200		2.4	0.39	1100		2.4	0.39	380		2.3	0.36
Potassium, Total	7440-09-7	NA	NA	NA	500		240	27	670		240	27	380		230	25
Selenium, Total	7782-49-2	11	5700	390	11		2	0.26	8.3		1.9	0.26	1.8		1.8	0.24
Silver, Total	7440-22-4	1	5700	390	ND		0.98	0.2	ND		0.97	0.19	ND		0.91	0.18
Sodium, Total	7440-23-5	NA	NA	NA	860		200	16	880		190	16	630		180	15
Thallium, Total	7440-28-0	3	79	5	ND		2	0.31	ND		1.9	0.31	ND		1.8	0.29
Vanadium, Total	7440-62-2	NA	1100	78	73		0.98	0.09	63		0.97	0.09	42		0.91	0.08
Zinc, Total	7440-66-6	930	110000	23000	2200		4.9	0.68	2000		4.9	0.68	600		4.5	0.63
GENERAL CHEMISTRY																
Specific Conductance	NONE	NA	NA	NA	140		10	10	250		10	10	290		10	10
Solids, Total	NONE	NA	NA	NA	79.6		0.1	NA	81.1		0.1	NA	87		0.1	NA
pH (H)	12408-02-5	NA	NA	NA	6.5		0	NA	6.4		0	NA	7.6		0	NA
Nitrogen, Nitrate/Nitrite	NONE	NA	NA	NA	4.5		1.2	0.34	15		1.2	0.33	4.2		1.1	0.3
Total Nitrogen	NONE	NA	NA	NA	5900		180	150	5700		180	150	2800		160	150
Nitrogen, Total Kjeldahl	NONE	NA	NA	NA	5900		180	38	5700		180	38	2800		160	35
Oil & Grease, Hem-Grav	NONE	NA	NA	NA	35600		251	251	44000		247	247	42200		230	230

*NJ-IGWS: New Jersey Impact to Groundwater Soil Screening Levels (IGWSSL) Criteria per November 2013 Guidance Regulation (Version 2.0).
*NJ-NRDCSRS: New Jersey Non-Residential Direct Contact Soil Remediation Standards Criteria per Soil Remediation Standards, last amended May 7, 2012.
*NJ-RDCSRS: New Jersey Residential Direct Contact Soil Remediation Standards Criteria per Soil Remediation Standards, last amended May 7, 2012.

Table 3a - Groundwater Data - VOCs
No. 1 Landfarm
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Volatiles															
Sample ID	Date	Benzene	Chlorobenzene	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	cis-1,2-Dichloroethene	Ethylbenzene	Tetrachloroethene	Toluene	Vinyl chloride	Xylenes (total)	Total TIC, Volatile	Methyl Tert Butyl Ether	Tertiary Butyl Alcohol
NJDEP GWQS		1	50	600	600	75	70	700	1	600	1	1,000	500	70	100
Maximum Conc.		ND	4.1	0.47	0.23	0.26	ND	ND	0.34	ND	ND	ND	4.2	ND	ND
L1-1	1/21/2005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
	4/28/2005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
	7/22/2005	ND	ND	NS	NS	NS	NS	ND	NS	ND	ND	ND	ND	ND	ND
	10/28/2005	ND	2.8	0.47	0.23	0.26	ND	ND	0.34	ND	ND	ND	4.2	NS	NS
	1/20/2006	ND	ND	ND	ND	ND	ND	ND	0.27	ND	ND	ND	ND	ND	ND
	4/28/2006	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/21/2006	ND	ND	NS	NS	NS	NS	ND	NS	ND	ND	ND	ND	ND	ND
	10/23/2006	ND	ND	ND	ND	ND	ND	ND	0.34	ND	ND	ND	ND	ND	ND
	1/26/2007	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/20/2007	ND	4.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/27/2007	ND	ND	NS	NS	NS	NS	ND	NS	ND	ND	ND	ND	ND	ND
	10/30/2007	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/11/2008	ND	0.52	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/17/2008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/22/2008	ND	ND	NS	NS	NS	NS	ND	NS	ND	ND	ND	ND	ND	ND
	10/29/2008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/22/2009	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/29/2009	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/29/2009	ND	ND	NS	NS	NS	NS	ND	NS	ND	ND	ND	ND	ND	ND
	10/26/2009	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/27/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/5/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/22/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	10/25/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/19/2011	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/20/2011	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/20/2011	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	10/21/2011	ND	ND	ND	ND	ND	ND	ND	0.39J	ND	ND	ND	ND	ND	ND
	1/19/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/24/2012	ND	ND	ND	ND	ND	ND	ND	0.19 J	ND	ND	ND	ND	ND	ND
	7/25/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	10/23/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/16/2013	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/24/2013	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/24/2013	ND	0.36 J	NA	NA	NA	NA	ND	NA	ND	ND	ND	NA	ND	ND
	10/9/2013	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/15/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/23/2014	ND	ND	ND	ND	ND	ND	ND	0.17 J	ND	ND	ND	ND	ND	ND
	7/23/2014	ND	ND	NA	NA	NA	NA	ND	NA	ND	ND	ND	NA	ND	ND
	10/15/2014	ND	ND	ND	ND	ND	ND	ND	0.27 J	ND	ND	ND	ND	ND	ND
	1/21/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/24/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

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Table 3a - Groundwater Data - VOCs
No. 1 Landfarm
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Volatiles															
Sample ID	Date	Benzene	Chlorobenzene	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	cis-1,2-Dichloroethene	Ethylbenzene	Tetrachloroethene	Toluene	Vinyl chloride	Xylenes (total)	Total TIC, Volatile	Methyl Tert Butyl Ether	Tertiary Butyl Alcohol
NJDEP GWQS		1	50	600	600	75	70	700	1	600	1	1,000	500	70	100
Maximum Conc.		0.61	**65.7**	0.2	1.2	3	0.28	ND	ND	ND	ND	ND	3.2	ND	ND
L1-2	1/21/2005	ND	1.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
	4/28/2005	ND	0.71	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
	7/22/2005	ND	ND	NS	NS	NS	NS	ND	NS	ND	ND	ND	ND	ND	ND
	10/28/2005	ND	5.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
	1/20/2006	ND	6.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/28/2006	ND	0.54	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/21/2006	ND	12.3	NS	NS	NS	NS	ND	NS	ND	ND	ND	ND	ND	ND
	10/23/2006	ND	0.71	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/26/2007	0.32	8.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/20/2007	ND	1.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/27/2007	ND	2.4	NS	NS	NS	NS	ND	NS	ND	ND	ND	ND	ND	ND
	10/30/2007	ND	3.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/11/2008	0.27	14.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/17/2008	0.44	9.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/22/2008	ND	21.8	NS	NS	NS	NS	ND	NS	ND	ND	ND	ND	ND	ND
	10/29/2008	ND	5.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/22/2009	0.61	21.7	0.2	0.37	1.1	0.25	ND	ND	ND	ND	ND	ND	ND	ND
	4/29/2009	0.33	16.3	ND	0.36	0.94	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/29/2009	ND	11.5	NS	NS	NS	NS	ND	NS	ND	ND	ND	ND	ND	ND
	10/27/2009	ND	6.4	ND	ND	0.51 J	ND	ND	ND	0.23 J	ND	ND	ND	ND	ND
	1/27/2010	0.3	26.5	ND	0.62	1.6	0.28	ND	ND	ND	ND	ND	3.2	ND	ND
	4/5/2010	0.42	24.8	ND	0.43	1.2	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/22/2010	ND	4.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	10/25/2010	ND	10.0	ND	ND	0.51	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/19/2011	ND	9.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/20/2011	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/20/2011	ND	6.2	ND	ND	0.38 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
	10/21/2011	ND	**65.7**	0.78 J	1.2	3.0	0.61J	ND	ND	0.43J	ND	0.33J	6.2(1)J	ND	ND
	1/19/2012	ND	25.9	0.36 J	0.52 J	1.3	0.27 J	ND	ND	ND	ND	ND	14.64 (1) J	ND	ND
	4/24/2012	ND	5.2	ND	ND	0.39 J	ND	ND	ND	ND	ND	ND	5.59 (2) J	ND	ND
	7/25/2012	ND	25.6	0.38 J	0.50 J	1.3	ND	ND	ND	ND	ND	ND	3.2 J	ND	ND
	10/23/2012	ND	16.9	0.25J	0.35J	0.92J	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/16/2013	ND	5.7	ND	ND	0.36 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/24/2013	ND	6.00	ND	ND	0.38J	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/24/2013	ND	19.0	NA	NA	NA	NA	ND	NA	ND	ND	ND	NA	ND	ND
	10/9/2013	ND	11.2	ND	0.24 J	0.65 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/15/2014	ND	1.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/23/2014	ND	2.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/23/2014	ND	7.5	NA	NA	NA	NA	ND	NA	ND	ND	ND	NA	ND	ND
	10/15/2014	ND	7.0	ND	0.28 J	0.74 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/21/2015	ND	35.7	0.63 J	0.80 J	2.2	0.42 J	ND	ND	ND	ND	ND	ND	ND	ND
	4/24/2015	ND	22.5	0.52 J	0.70 J	1.7	0.23 J	ND	ND	ND	ND	ND	6.1 J (1)	ND	ND

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Table 3a - Groundwater Data - VOCs
No. 1 Landfarm
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Sample ID	Date	Volatiles													
		Benzene	Chlorobenzene	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	cis-1,2-Dichloroethene	Ethylbenzene	Tetrachloroethene	Toluene	Vinyl chloride	Xylenes (total)	Total TIC, Volatile	Methyl Tert Butyl Ether	Tertiary Butyl Alcohol
NJDEP GWQS		1	50	600	600	75	70	700	1	600	1	1,000	500	70	100
Maximum Conc.		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.5	2.9	ND
	1/21/2005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
	5/4/2005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.5	NS	NS
	7/22/2005	ND	ND	NS	NS	NS	NS	ND	NS	ND	ND	ND	ND	ND	ND
	10/28/2005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
	1/20/2006	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.1	ND
	4/28/2006	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.4	ND
	7/21/2006	ND	ND	NS	NS	NS	NS	ND	NS	ND	ND	ND	ND	2.9	ND
	10/23/2006	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.5	ND
	1/26/2007	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.2	ND
	4/20/2007	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.79	ND
	7/27/2007	ND	ND	NS	NS	NS	NS	ND	NS	ND	ND	ND	ND	ND	ND
	10/30/2007	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.83	ND
	1/11/2008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.72	ND
	4/17/2008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.58	ND
	7/22/2008	ND	ND	NS	NS	NS	NS	ND	NS	ND	ND	ND	ND	0.71	ND
	10/29/2008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.72	ND
	1/22/2009	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.81	ND
	4/29/2009	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.64	ND
	7/29/2009	ND	ND	NS	NS	NS	NS	ND	NS	ND	ND	ND	ND	0.63	ND
	10/26/2009	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.61	ND
	1/27/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.59	ND
L1-3	4/5/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	ND
	7/22/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	10/25/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	ND
	1/19/2011	Could not locate due to snow.													
	4/20/2011	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.34	ND
	7/20/2011	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.40J	ND
	10/21/2011	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.73J	ND
	1/19/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.30 J	ND
	4/24/2012	ND	0.24 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.30 J	ND
	7/25/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.44 J	ND
	10/23/2012	ND	0.21J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.61 J	ND
	1/16/2013	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/24/2013	ND	0.26J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/24/2013	ND	ND	NA	NA	NA	NA	ND	NA	ND	ND	ND	NA	ND	ND
	10/9/2013	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.32 J	ND
	1/15/2014	ND	0.33 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/23/2014	ND	0.22 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/23/2014	ND	ND	NA	NA	NA	NA	ND	NA	ND	ND	ND	NA	ND	ND
	10/15/2014	ND	0.30 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/21/2015	ND	0.39 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	7 (2) J	ND	ND
	4/24/2015	ND	0.42 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

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Table 3a - Groundwater Data - VOCs
No. 1 Landfarm
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Sample ID	Date	Benzene	Chlorobenzene	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	cis-1,2-Dichloroethene	Ethylbenzene	Tetrachloroethene	Toluene	Vinyl chloride	Xylenes (total)	Total TIC, Volatile	Methyl Tert Butyl Ether	Tertiary Butyl Alcohol
		Volatiles													
NJDEP GWQS		1	50	600	600	75	70	700	1	600	1	1,000	500	70	100
Maximum Conc.		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
L1-4	1/21/2005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
	5/4/2005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
	7/22/2005	ND	ND	NS	NS	NS	NS	ND	NS	ND	ND	ND	ND	ND	ND
	10/28/2005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
	1/20/2006	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/28/2006	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/21/2006	ND	ND	NS	NS	NS	NS	ND	NS	ND	ND	ND	ND	ND	ND
	10/23/2006	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/26/2007	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/20/2007	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/27/2007	ND	ND	NS	NS	NS	NS	ND	NS	ND	ND	ND	ND	ND	ND
	10/30/2007	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/11/2008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/17/2008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/22/2008	ND	ND	NS	NS	NS	NS	ND	NS	ND	ND	ND	ND	ND	ND
	10/29/2008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/22/2009	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/29/2009	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/29/2009	ND	ND	NS	NS	NS	NS	ND	NS	ND	ND	ND	ND	ND	ND
	10/26/2009	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/27/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/5/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/22/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	10/25/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/19/2011	Could not locate due to snow.													
	4/20/2011	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/20/2011	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	10/21/2011	ND	ND	ND	ND	ND	ND	ND	ND	0.29J	ND	ND	ND	ND	ND
	1/19/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/24/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/25/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	10/23/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/16/2013	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.3 (1) J	ND	ND
	4/24/2013	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/24/2013	ND	ND	NA	NA	NA	NA	ND	NA	ND	ND	ND	NA	ND	ND
	10/9/2013	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/15/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/23/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/23/2014	ND	ND	NA	NA	NA	NA	ND	NA	ND	ND	ND	NA	ND	ND
	10/15/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/21/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/24/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND - Not Detected
NA - Not Analyzed or Not Applicable
J - Estimated Value

Values in **bold** indicate compound above applicable NJDEP GWQS
GWQS - Groundwater Quality Standard
All data is reported in ug/L unless otherwise noted

Table 3a - Groundwater Data - VOCs
No. 1 Landfarm
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Sample ID	Date	Benzene	Chlorobenzene	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	cis-1,2-Dichloroethene	Ethylbenzene	Tetrachloroethene	Toluene	Vinyl chloride	Xylenes (total)	Total TIC, Volatile	Methyl Tert Butyl Ether	Tertiary Butyl Alcohol
		Volatiles													
NJDEP GWQS		1	50	600	600	75	70	700	1	600	1	1,000	500	70	100
Maximum Conc.		ND	0.76	ND	ND	ND	ND	ND	ND	ND	ND	ND	3	1.8	68.3
BG-2	1/21/2005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
	4/28/2005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.0	NS	NS
	7/22/2005	ND	0.76	NS	NS	NS	NS	ND	NS	ND	ND	ND	ND	ND	ND
	10/28/2005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
	1/20/2006	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/28/2006	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.42	ND
	7/21/2006	ND	0.56	NS	NS	NS	NS	ND	NS	ND	ND	ND	ND	1.4	ND
	10/23/2006	ND	0.44	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.76	ND
	1/26/2007	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/20/2007	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/27/2007	ND	0.75	NS	NS	NS	NS	ND	NS	ND	ND	ND	ND	1.7	26.4
	10/30/2007	ND	0.75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.3	ND
	1/11/2008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/17/2008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/22/2008	ND	0.38	NS	NS	NS	NS	ND	NS	ND	ND	ND	ND	0.52	ND
	10/29/2008	ND	0.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.66	16.1
	1/22/2009	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/29/2009	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/29/2009	ND	0.52	NS	NS	NS	NS	ND	NS	ND	ND	ND	ND	1.8	61.8
	10/26/2009	ND	0.94 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/27/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/5/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/22/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	10/25/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.49	40
	1/19/2011	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/20/2011	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/20/2011	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	10/21/2011	ND	0.61 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.5(1)J	1.2	52.7
	1/19/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/24/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/25/2012	ND	0.36 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	10/23/2012	ND	0.49J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.89 J	52.1
	1/16/2013	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/24/2013	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/24/2013	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	10/9/2013	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	1/15/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/23/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/23/2014	ND	ND	NA	NA	NA	NA	ND	NA	ND	ND	ND	NA	ND	ND
	10/15/2014	ND	0.34 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	68.3
	1/21/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.3 (1) J	ND	ND
	4/24/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND - Not Detected
NA - Not Analyzed or Not Applicable
J - Estimated Value

Values in **bold** indicate compound above applicable NJDEP GWQS
GWQS - Groundwater Quality Standard
All data is reported in ug/L unless otherwise noted

Table 3a - Groundwater Data - VOCs
No. 1 Landfarm
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Sample ID	Date	Benzene	Chlorobenzene	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	cis-1,2-Dichloroethene	Ethylbenzene	Tetrachloroethene	Toluene	Vinyl chloride	Xylenes (total)	Total TIC, Volatile	Methyl Tert Butyl Ether	Tertiary Butyl Alcohol
		Volatiles													
NJDEP GWQS		1	50	600	600	75	70	700	1	600	1	1,000	500	70	100
Maximum Conc.		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BG-3	7/25/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BG-3	10/23/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BG-3	1/16/2013	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BG-3	4/24/2013	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BG-3	7/24/2013	ND	ND	NA	NA	NA	NA	ND	NA	ND	ND	ND	NA	ND	ND
BG-3	10/9/2013	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BG-3	1/15/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BG-3	4/23/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BG-3	7/23/2014	ND	ND	NA	NA	NA	NA	ND	NA	ND	ND	ND	NA	ND	ND
BG-3	10/15/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BG-3	1/21/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BG-3	4/24/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND - Not Detected
NA - Not Analyzed or Not Applicable
J - Estimated Value

Values in **bold** indicate compound above applicable NJDEP GWQS
GWQS - Groundwater Quality Standard
All data is reported in ug/L unless otherwise noted

Table 3b - Groundwater Data - SVOCs
No. 1 Landfarm
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Sample ID	Date	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)flouranthene	Benzo(g,h,i)perylene	Chrysene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Di-n-butyl phthalate	Di-n-octyl phthalate	Dimethyl phthalate	bis(2-Ethylhexyl)phthalate	Fluoranthene	Fluorene	Phenanthrene	Phenol	Pyrene	Total TIC, Semi-Volatile
		Semi-Volatile Organic Compounds																			
NJDEP GWQS		400	NA	2,000	0.1	0.1	0.2	NA	5	600	75	700	100	50	3	300	300	NA	2,000	200	500
Maximum Conc.		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.5	ND	2.5	**15.8**	1.6	ND	1.2	ND	1.1	200.9
	1/21/2005	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	36
	4/28/2005	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	7/22/2005	NS	NR	ND	ND	NR	NR	NR	ND	NR	NS	4.5	ND	NR	1.1	ND	NR	NS	NR	ND	ND
	10/28/2005	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	2.9	ND	NR	ND	NR	ND	4.2
	1/20/2006	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	4/28/2006	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	27.5
	7/21/2006	NS	NR	ND	ND	NR	NR	NR	ND	NR	NS	ND	ND	NR	ND	ND	NR	NS	NR	ND	ND
	10/23/2006	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	1/26/2007	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	2.6	ND	NR	ND	NR	ND	70
	4/20/2007	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	2.7	ND	NR	ND	NR	ND	8.8
	7/27/2007	NS	NR	ND	ND	NR	NR	NR	ND	NR	NS	ND	ND	NR	ND	ND	NR	NS	NR	ND	ND
	10/30/2007	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	2.3	ND	NR	ND	NR	ND	90.6
	1/11/2008	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	**15.8**	ND	NR	ND	NR	ND	200.9
	4/17/2008	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	29.1
	7/22/2008	NS	NR	ND	ND	NR	NR	NR	ND	NR	NS	ND	ND	NR	**3.7**	ND	NR	NS	NR	ND	ND
	10/29/2008	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	1.2	ND	NR	ND	NR	ND	ND
	1/22/2009	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	1.3	ND	NR	ND	NR	ND	ND
	4/29/2009	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	2.3	ND	NR	ND	NR	ND	4.8
	7/29/2009	NS	NR	ND	ND	NR	NR	NR	ND	NR	NS	ND	ND	NR	1.3	ND	NR	NS	NR	ND	ND
	10/26/2009	ND	NR	0.44 J	**0.59 J**	NR	NR	NR	0.53 J	NR	ND	ND	ND	NR	ND	1.6	NR	1.2	NR	1.1	ND
	1/27/2010	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
L1-1	4/5/2010	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	40.6
	7/22/2010	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	10/25/2010	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	72
	1/19/2011	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	1.1	ND	NR	ND	NR	ND	27
	4/20/2011	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	8.6
	7/20/2011	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	8.2(1)J
	10/21/2011	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	1.7 J	ND	NR	ND	NR	ND	ND
	1/19/2012	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	**4.8**	ND	NR	ND	NR	ND	ND
	4/24/2012	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	7/25/2012	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	13 J
	10/23/2012	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	1/16/2013	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	13.6 (5)
	4/24/2013	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	7/24/2013	NA	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	2.5	ND	ND	NR	ND	NR	ND	NA
	10/9/2013	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	ND	ND	ND	NR	ND	NR	ND	5.2 (1) J
	1/15/2014	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	ND	1.5	ND	NR	ND	NR	ND	7.6 (1) J
	4/23/2014	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	ND	1.0 J	ND	NR	ND	NR	ND	30.3 (2)
	7/23/2014	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	ND	ND	ND	NR	ND	NR	ND	NA
	10/15/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.4 B	ND	ND	1.3 BJ	ND	ND	ND	NR	ND	34.8 (4)
	1/21/2015	ND (0.35)	ND (0.38)	ND (0.40)	ND (0.36)	ND (0.37)	ND (0.59)	ND (0.42)	ND (0.25)	ND (0.16)	ND (0.18)	ND (0.59)	ND (0.57)	ND (0.33)	ND (0.66)	ND (0.25)	ND (0.45)	ND (0.36)	NR	ND (0.34)	ND
	4/24/2015	ND (0.35)	ND (0.38)	ND (0.40)	ND (0.36)	ND (0.37)	ND (0.59)	ND (0.42)	ND (0.25)	ND (0.16)	ND (0.18)	ND (0.59)	ND (0.57)	ND (0.33)	ND (0.66)	ND (0.25)	ND (0.45)	ND (0.36)	NR	ND (0.34)	ND

All data reported in ug/l unless otherwise noted
Values in **bold** indicated an exceedance of the NJDEP GWQS
1- Storage Temperature Exceeded 6° Celsius due to power outage
Tropical Cyclone Sandy (Oct 29-30 2012)

* Phenol as reported by EPA method 625
** Analyzed outside of Hold time
ND- Not Detected

NA- Not Applicable
NS- Not Sampled
B- Analyte found in associated method blank

NR- Not Reported
J- Estimate Value
- Indicates MDL exceeds applicable standard

Table 3b - Groundwater Data - SVOCs
No. 1 Landfarm
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Semi-Volatile Organic Compounds																					
Sample ID	Date	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)flouranthene	Benzo(g,h,i)perylene	Chrysene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Di-n-butyl phthalate	Di-n-octyl phthalate	Dimethyl phthalate	bis(2-Ethylhexyl)phthalate	Fluoranthene	Fluorene	Phenanthrene	Phenol	Pyrene	Total TIC, Semi-Volatile
NJDEP GWQS		400	NA	2,000	0.1	0.1	0.2	NA	5	600	75	700	100	50	3	300	300	NA	2,000	200	500
Maximum Conc.		2.4	6.2	1.2	**0.77**	**1.3**	**0.94**	ND	ND	ND	1.3	ND	ND	ND	**3.1**	ND	ND	1.1	ND	1.3	123.1
	1/21/2005	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	48
	4/28/2005	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	2.3	ND	NR	ND	NR	ND	19
	7/22/2005	NS	NR	ND	ND	NR	NR	NR	ND	NR	NS	ND	ND	NR	ND	ND	NR	NS	NR	ND	ND
	10/28/2005	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	1/20/2006	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	9.4
	4/28/2006	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	7/21/2006	NS	NR	ND	ND	NR	NR	NR	ND	NR	NS	ND	ND	NR	1.2	ND	NR	NS	NR	ND	ND
	10/23/2006	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	1/26/2007	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	53
	4/20/2007	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	4.1
	7/27/2007	NS	NR	ND	ND	NR	NR	NR	ND	NR	NS	ND	ND	NR	ND	ND	NR	NS	NR	ND	ND
	10/30/2007	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	1.3	ND	NR	ND	NR	ND	101.2
	1/11/2008	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	112.8
	4/17/2008	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	16.4
	7/22/2008	NS	NR	ND	ND	NR	NR	NR	ND	NR	NS	ND	ND	NR	**3.1**	ND	NR	NS	NR	ND	ND
	10/29/2008	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	1.4	ND	NR	ND	NR	ND	ND
	1/22/2009	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	4/29/2009	ND	NR	ND	ND	NR	NR	NR	ND	NR	0.78	ND	ND	NR	ND	ND	NR	ND	NR	ND	123.1
	7/29/2009	NS	NR	ND	ND	NR	NR	NR	ND	NR	0.8	ND	ND	NR	ND	ND	NR	NS	NR	ND	ND
	10/27/2009	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	1/27/2010	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
L1-2	4/5/2010	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	83.9
	7/22/2010	ND	NR	ND	ND	NR	NR	NR	ND	NR	1.2	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	10/25/2010	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	14.0
	1/19/2011	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	4/20/2011	ND	NR	ND	ND	NR	NR	NR	ND	NR	0.63	ND	ND	NR	ND	ND	NR	ND	NR	ND	18.0
	7/20/2011	ND	NR	ND	ND	NR	NR	NR	ND	NR	1.0 J	ND	ND	NR	ND	ND	NR	ND	NR	ND	18.6(2)J
	10/21/2011	ND	NR	ND	ND	NR	NR	NR	ND	NR	1.3 J	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	1/19/2012	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	11.76(1) J
	4/24/2012	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	7/25/2012	ND	NR	ND	ND	NR	NR	NR	ND	NR	1.3	ND	ND	NR	ND	ND	NR	ND	NR	ND	13 J
	10/23/2012	ND	NR	ND	ND	NR	NR	NR	ND	NR	1.1J	ND	ND	NR	ND	ND	NR	ND	NR	ND	40.7(5)J
	1/16/2013	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	16.5 (4)
	4/24/2013	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	7/24/2013	NA	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	ND	ND	ND	NR	ND	NR	ND	NA
	10/9/2013	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	ND	ND	ND	NR	ND	NR	ND	ND
	1/15/2014	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	ND	1.1 J	ND	NR	ND	NR	ND	ND
	4/23/2014	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	ND	ND	ND	NR	ND	NR	ND	31.2 (2)
	7/23/2014	ND	NR	ND	ND	ND	ND	ND	ND	NR	ND	ND	ND	ND	ND	ND	NR	ND	NR	ND	NA
	10/15/2014	2.4	6.2	1.2	**0.77 J**	**1.3**	**0.94 J**	0.98 J	0.78 J	NR	0.66 J	5.1 B	ND	ND	1.6 BJ	0.67 J	ND	1.1	ND	1.3	50.8 (7)
	1/21/2015	ND (0.35)	ND (0.38)	ND (0.40)	ND (0.36)	ND (0.37)	ND (0.59)	ND (0.42)	ND (0.25)	0.55 J	1.3 J	ND (0.59)	ND (0.57)	ND (0.33)	ND (0.66)	ND (0.25)	ND (0.45)	ND (0.36)	ND (0.50)	ND (0.34)	42.7 (5)
	4/24/2015	ND (0.35)	ND (0.38)	ND (0.40)	ND (0.36)	ND (0.37)	ND (0.59)	ND (0.42)	ND (0.25)	ND (0.16)	1.1 J	ND (0.59)	ND (0.57)	ND (0.33)	2.6 B	ND (0.25)	ND (0.45)	ND (0.36)	ND (0.50)	ND (0.34)	5.8 J (1)

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** Analyzed outside of Hold time
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Table 3b - Groundwater Data - SVOCs
No. 1 Landfarm
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Semi-Volatile Organic Compounds																					
Sample ID	Date	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)flouranthene	Benzo(g,h,i)perylene	Chrysene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Di-n-butyl phthalate	Di-n-octyl phthalate	Dimethyl phthalate	bis(2-Ethylhexyl)phthalate	Fluoranthene	Fluorene	Phenanthrene	Phenol	Pyrene	Total TIC, Semi-Volatile
NJDEP GWQS		400	NA	2,000	0.1	0.1	0.2	NA	5	600	75	700	100	50	3	300	300	NA	2,000	200	500
Maximum Conc.		2	2.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**16.6**	ND	ND	1.1	ND	0.6	97.2
L1-3	1/21/2005	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	2.1	ND	NR	ND	NR	ND	21.9
	5/4/2005	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	7/22/2005	NS	NR	ND	ND	NR	NR	NR	ND	NR	NS	ND	ND	NR	1.7	ND	NR	NS	NR	ND	ND
	10/28/2005	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	1/20/2006	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	1.7	ND	NR	ND	NR	ND	ND
	4/28/2006	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	2.4	ND	NR	ND	NR	ND	ND
	7/21/2006	NS	NR	ND	ND	NR	NR	NR	ND	NR	NS	ND	ND	NR	2.2	ND	NR	NS	NR	ND	ND
	10/23/2006	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	**16.6**	ND	NR	ND	NR	ND	19.0
	1/26/2007	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	2.1	ND	NR	ND	NR	0.6	31.0
	4/20/2007	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	**3.8**	ND	NR	ND	NR	ND	15.0
	7/27/2007	NS	NR	ND	ND	NR	NR	NR	ND	NR	NS	ND	ND	NR	**5.2**	ND	NR	NS	NR	ND	ND
	10/30/2007	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	**5.2**	ND	NR	ND	NR	ND	43.2
	1/11/2008	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	**6.5**	ND	NR	ND	NR	ND	34.4
	4/17/2008	0.5	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	**7.2**	ND	NR	ND	NR	ND	97.2
	7/22/2008	NS	NR	ND	ND	NR	NR	NR	ND	NR	NS	ND	ND	NR	**4.3**	ND	NR	NS	NR	ND	ND
	10/29/2008	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	1/22/2009	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	**3.1**	ND	NR	ND	NR	ND	4.7
	4/29/2009	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	1.5	ND	NR	ND	NR	ND	ND
	7/29/2009	NS	NR	ND	ND	NR	NR	NR	ND	NR	NS	ND	ND	NR	2.2	ND	NR	NS	NR	ND	ND
	10/26/2009	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	1/27/2010	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	4/5/2010	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	46
	7/22/2010	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	10/25/2010	0.47	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	1/19/2011																				
	4/20/2011	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	24.4
	7/20/2011	0.56 J	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	1.8 J	ND	NR	ND	NR	ND	ND
	10/21/2011	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	1/19/2012	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	**10.7**	ND	NR	ND	NR	ND	ND
	4/24/2012	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	7/25/2012	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	21.7
	10/23/2012	0.49J	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	1/16/2013	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	1.0 J	ND	NR	ND	NR	ND	5.4 (2) J
	4/24/2013	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	8.8 (1) J
	7/24/2013	NA	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	ND	ND	ND	NR	ND	NR	ND	NA
	10/9/2013	0.69 J	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	ND	ND	ND	NR	ND	NR	ND	ND
	1/15/2014	0.64 J	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	ND	1.3 J	ND	NR	ND	NR	ND	14.8 (2)
	4/23/2014	0.52 J	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	ND	1.3 J	ND	NR	ND	NR	ND	50.8 (5)
	7/23/2014	NR	NR	ND	ND	ND	ND	NR	ND	NR	ND	ND	ND	ND	ND	ND	NR	ND	NR	ND	NA
	10/15/2014	2.0	2.8	0.56 J	ND	ND	ND	ND	ND	NR	ND	10.9 B	ND	ND	2.2 B	ND	0.90 J	1.1	ND	0.61 J	72.2 (5)
	1/21/2015	0.85 J	ND (0.38)	ND (0.40)	ND (0.36)	ND (0.37)	ND (0.59)	ND (0.42)	ND (0.25)	ND (0.16)	ND (0.18)	ND (0.59)	ND (0.57)	ND (0.33)	ND (0.66)	ND (0.25)	ND (0.45)	ND (0.36)	ND (0.50)	ND (0.34)	ND
	4/24/2015	0.41 J	ND (0.38)	ND (0.40)	ND (0.36)	ND (0.37)	ND (0.59)	ND (0.42)	ND (0.25)	ND (0.16)	ND (0.18)	ND (0.59)	ND (0.57)	ND (0.33)	ND (0.66)	ND (0.25)	ND (0.45)	ND (0.36)	ND (0.50)	ND (0.34)	ND

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Table 3b - Groundwater Data - SVOCs
No. 1 Landfarm
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Sample ID	Date	Semi-Volatile Organic Compounds																			
		Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)flouranthene	Benzo(g,h,i)perylene	Chrysene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Di-n-butyl phthalate	Di-n-octyl phthalate	Dimethyl phthalate	bis(2-Ethylhexyl)phthalate	Fluoranthene	Fluorene	Phenanthrene	Phenol	Pyrene	Total TIC, Semi-Volatile
NJDEP GWQS		400	NA	2,000	0.1	0.1	0.2	NA	5	600	75	700	100	50	3	300	300	NA	2,000	200	500
Maximum Conc.		ND	3.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**14.2**	ND	ND	ND	19.7	ND	310
L1-4	1/21/2005	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	**4.8**	ND	NR	ND	NR	ND	132.3
	5/4/2005	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	310
	7/22/2005	NS	NR	ND	ND	NR	NR	NR	ND	NR	NS	ND	ND	NR	ND	ND	NR	NS	NR	ND	ND
	10/28/2005	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	1.2	ND	NR	ND	NR	ND	ND
	1/20/2006	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	4/28/2006	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	2.0	ND	NR	ND	NR	ND	50.0
	7/21/2006	NS	NR	ND	ND	NR	NR	NR	ND	NR	NS	ND	ND	NR	2.5	ND	NR	NS	NR	ND	ND
	10/23/2006	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	16.9
	1/26/2007	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	1.0	ND	NR	ND	NR	ND	44.6
	4/20/2007	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	**3.4**	ND	NR	ND	NR	ND	45.9
	7/27/2007	NS	NR	ND	ND	NR	NR	NR	ND	NR	NS	ND	ND	NR	ND	ND	NR	NS	NR	ND	ND
	10/30/2007	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	1.1	ND	NR	ND	NR	ND	247.2
	1/11/2008	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	1.9	ND	NR	ND	NR	ND	136.9
	4/17/2008	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	7/22/2008	NS	NR	ND	ND	NR	NR	NR	ND	NR	NS	ND	ND	NR	ND	ND	NR	NS	NR	ND	ND
	10/29/2008	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	16
	1/22/2009	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	107.3
	4/29/2009	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	9.6
	7/29/2009	NS	NR	ND	ND	NR	NR	NR	ND	NR	NS	ND	ND	NR	**6.5**	ND	NR	NS	NR	ND	ND
	10/26/2009	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	1/27/2010	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	4/5/2010	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	7/22/2010	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	10/25/2010	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	1/19/2011																				
	4/20/2011	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	15.0
	7/20/2011	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	**3.0**	ND	NR	ND	NR	ND	ND
	10/21/2011	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	5.1(1)J
	1/19/2012	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	**14.2**	ND	NR	ND	NR	ND	19.7(3)J
	4/24/2012	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	1.9 J	ND	NR	ND	NR	ND	ND
	7/25/2012	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	11 J
	10/23/2012	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	1/16/2013	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	1.4 J	ND	NR	ND	NR	ND	6.7 (1) J
	4/24/2013	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	**10.7**	ND	NR	ND	NR	ND	**555.8**
	7/24/2013	NA	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	ND	ND	ND	NR	ND	NR	ND	NA
	10/9/2013	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	ND	ND	ND	NR	ND	NR	ND	ND
	1/15/2014	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	ND	1.4 J	ND	NR	ND	NR	ND	11.2 (2)
	4/23/2014	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	ND	ND	ND	NR	ND	NR	ND	34.7 (3)
	7/23/2014	NR	NR	ND	ND	ND	ND	NR	ND	NR	ND	ND	ND	ND	ND	ND	NR	ND	NR	ND	NA
	10/15/2014	0.93 J	3.7	0.46 J	ND	ND	ND	ND	ND	ND	ND	17.7 B	ND	ND	**23.9 B**	ND	ND	0.88 J	19.7	ND	**2,525**
	1/21/2015	ND (0.35)	ND (0.38)	ND (0.40)	ND (0.36)	ND (0.37)	ND (0.59)	ND (0.42)	ND (0.25)	ND (0.16)	ND (0.18)	ND (0.59)	ND (0.57)	ND (0.33)	ND (0.66)	ND (0.25)	ND (0.45)	ND (0.36)	ND (0.50)	ND (0.34)	4.9 (1) J
	4/24/2015	ND (0.35)	ND (0.38)	ND (0.40)	ND (0.36)	ND (0.37)	ND (0.59)	ND (0.42)	ND (0.25)	ND (0.16)	ND (0.18)	ND (0.59)	ND (0.57)	ND (0.33)	ND (0.66)	ND (0.25)	ND (0.45)	ND (0.36)	ND (0.50)	ND (0.34)	ND

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Sample ID	Date	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)flouranthene	Benzo(g,h,i)perylene	Chrysene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Di-n-butyl phthalate	Di-n-octyl phthalate	Dimethyl phthalate	bis(2-Ethylhexyl)phthalate	Fluoranthene	Fluorene	Phenanthrene	Phenol	Pyrene	Total TIC, Semi-Volatile
NJDEP GWQS		400	NA	2,000	0.1	0.1	0.2	NA	5	600	75	700	100	50	3	300	300	NA	2,000	200	500
Maximum Conc.		ND	1.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.6	ND	**6.2**	ND	ND	ND	ND	ND	62.6
BG-2	1/21/2005	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	1.1	ND	NR	ND	NR	ND	61
	4/28/2005	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	1.3	ND	NR	ND	NR	ND	19
	7/22/2005	NS	NR	ND	ND	NR	NR	NR	ND	NR	NS	ND	ND	NR	ND	ND	NR	NS	NR	ND	ND
	10/28/2005	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	1.7	ND	NR	ND	NR	ND	ND
	1/20/2006	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	2.5	ND	NR	ND	NR	ND	ND
	4/28/2006	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	14
	7/21/2006	NS	NR	ND	ND	NR	NR	NR	ND	NR	NS	ND	ND	NR	ND	ND	NR	NS	NR	ND	ND
	10/23/2006	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	1.8	ND	NR	ND	NR	ND	25
	1/26/2007	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	1.4	ND	NR	ND	NR	ND	38
	4/20/2007	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	**3.2**	ND	NR	ND	NR	ND	ND
	7/27/2007	NS	NR	ND	ND	NR	NR	NR	ND	NR	NS	ND	ND	NR	**5.9**	ND	NR	NS	NR	ND	ND
	10/30/2007	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	**3.1**	ND	NR	ND	NR	ND	62.6
	1/11/2008	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	**5.2**	ND	NR	ND	NR	ND	45
	4/17/2008	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	9.1
	7/22/2008	NS	NR	ND	ND	NR	NR	NR	ND	NR	NS	ND	ND	NR	**3.5**	ND	NR	NS	NR	ND	ND
	10/29/2008	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	**3**	ND	NR	ND	NR	ND	11
	1/22/2009	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	4/29/2009	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	1.3	ND	NR	ND	NR	ND	4.5
	7/29/2009	NS	NR	ND	ND	NR	NR	NR	ND	NR	NS	ND	1.6	NR	1.4	ND	NR	NS	NR	ND	ND
	10/26/2009	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	1/27/2010	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	4/5/2010	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	7/22/2010	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	10/25/2010	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	4.1
	1/19/2011	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	16
	4/20/2011	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	7/20/2011	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	10/21/2011	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	1/19/2012	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	4/24/2012	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	7/25/2012	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	6 J
	10/23/2012	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	1/16/2013	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	17.0 (3)
	4/24/2013	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	7/24/2013	NS	NR	NS	NS	NR	NR	NR	NS	NR	NS	NS	NS	NS	NS	NS	NR	NS	NR	NS	NS
	10/9/2013	NS	NR	NS	NS	NR	NR	NR	NS	NR	NS	NS	NS	NS	NS	NS	NR	NS	NR	NS	NS
	1/15/2014	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	ND	**6.2**	ND	NR	ND	NR	ND	10.2
	4/23/2014	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	ND	ND	ND	NR	ND	NR	ND	28.2 (2)
	7/23/2014	NR	NR	ND	ND	ND	ND	NR	ND	NR	ND	ND	ND	ND	ND	ND	NR	ND	NR	ND	NA
	10/15/2014	0.82 J	1.7	ND	ND	ND	ND	ND	ND	NR	ND	9.6 B	ND	ND	1.5 BJ	ND	0.61 J	0.79 J	ND	ND	47.9 (7)
	1/21/2015	ND (0.35)	ND (0.38)	ND (0.40)	ND (0.36)	ND (0.37)	ND (0.59)	ND (0.42)	ND (0.25)	ND (0.16)	ND (0.18)	ND (0.59)	ND (0.57)	ND (0.33)	ND (0.66)	ND (0.25)	ND (0.45)	ND (0.36)	ND (0.50)	ND (0.34)	ND
	4/24/2015	ND (0.35)	ND (0.38)	ND (0.40)	ND (0.36)	ND (0.37)	ND (0.59)	ND (0.42)	ND (0.25)	ND (0.16)	ND (0.18)	ND (0.59)	ND (0.57)	ND (0.33)	ND (0.66)	ND (0.25)	ND (0.45)	ND (0.36)	ND (0.50)	ND (0.34)	ND

All data reported in ug/l unless otherwise noted
Values in **bold** indicated an exceedance of the NJDEP GWQS
1- Storage Temperature Exceeded 6° Celsius due to power outage
Tropical Cyclone Sandy (Oct 29-30 2012)

* Phenol as reported by EPA method 625
** Analyzed outside of Hold time
ND- Not Detected

NA- Not Applicable
NS- Not Sampled
B- Analyte found in associated method blank

NR- Not Reported
J- Estimate Value
- Indicates MDL exceeds applicable standard

Table 3b - Groundwater Data - SVOCs
No. 1 Landfarm
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Semi-Volatile Organic Compounds																					
Sample ID	Date	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)flouranthene	Benzo(g,h,i)perylene	Chrysene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Di-n-butyl phthalate	Di-n-octyl phthalate	Dimethyl phthalate	bis(2-Ethylhexyl)phthalate	Fluoranthene	Fluorene	Phenanthrene	Phenol	Pyrene	Total TIC, Semi-Volatile
NJDEP GWQS		400	NA	2,000	0.1	0.1	0.2	NA	5	600	75	700	100	50	3	300	300	NA	2,000	200	500
Maximum Conc.		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BG-3	7/25/2012	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	9.6 J
	10/23/2012	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	1/16/2013	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	15.1 (3)
	4/24/2013	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	NR	ND	ND	NR	ND	NR	ND	ND
	7/24/2013	NA	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	ND	ND	ND	NR	ND	NR	ND	NA
	10/9/2013	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	ND	ND	ND	NR	ND	NR	ND	ND
	1/15/2014	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	ND	ND	ND	NR	ND	NR	ND	ND
	4/23/2014	ND	NR	ND	ND	NR	NR	NR	ND	NR	ND	ND	ND	ND	ND	ND	NR	ND	NR	ND	13 (1) J
	7/23/2014	NR	NR	ND	ND	NR	ND	NR	ND	NR	ND	ND	ND	ND	ND	ND	NR	ND	NR	ND	NA
	10/15/2014	0.40 J	0.96 J	ND	ND	ND	ND	ND	ND	NR	ND	13.3 B	ND	ND	1.7 BJ	ND	ND	0.53 J	ND	ND	72.5 (6)
	1/21/2015	ND (0.35)	ND (0.38)	ND (0.40)	ND (0.36)	ND (0.37)	ND (0.59)	ND (0.42)	ND (0.25)	ND (0.16)	ND (0.18)	ND (0.59)	ND (0.57)	ND (0.33)	ND (0.66)	ND (0.25)	ND (0.45)	ND (0.36)	ND (0.50)	ND (0.34)	ND
	4/24/2015	ND (0.35)	ND (0.38)	ND (0.40)	ND (0.36)	ND (0.37)	ND (0.59)	ND (0.42)	ND (0.25)	ND (0.16)	ND (0.18)	ND (0.59)	ND (0.57)	ND (0.33)	1.2 BJ	ND (0.25)	ND (0.45)	ND (0.36)	ND (0.50)	ND (0.34)	ND

All data reported in ug/l unless otherwise noted
Values in **bold** indicated an exceedance of the NJDEP GWQS
1- Storage Temperature Exceeded 6° Celsius due to power outage Tropical Cyclone Sandy (Oct 29-30 2012)

* Phenol as reported by EPA method 625
** Analyzed outside of Hold time
ND- Not Detected

NA- Not Applicable
NS- Not Sampled
B- Analyte found in associated method blank

NR- Not Reported
J- Estimate Value
(shaded) - Indicates MDL exceeds applicable standard

Table 3c - Groundwater Data
No. 1 Landfarm
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Sample ID	Date	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Copper	Cobalt	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
		Metals															
NJDEP GWQS		6	3	6,000	1	4	70	1,300	100	5	2	100	40	40	2	NA	2,000
Maximum Conc.		**6.7**	**9**	ND	ND	ND	22.2	29.8	ND	**39.3**	0.41	28.6	ND	ND	ND	ND	237
L1-1	1/21/2005	NS	<5.0	NA	NA	<4.0	<10	<25	NA	3.1	<0.20	<40	<5.0	<10	NS	NA	90.7
	4/28/2005	NS	<5.0	NA	NA	<4.0	<10	<25	NA	<3.0	<0.20	<40	<5.0	<10	NS	NA	142
	7/22/2005	**6.7**	<5.0	NA	<5.0	<4.0	<10	<25	NA	<3.0	<0.20	<40	<5.0	NA	<10	NA	NS
	10/28/2005	NS	<5.0	NA	NA	<4.0	<10	<25	NA	<3.0	<0.20	<40	<5.0	<10	NS	NS	<20
	1/20/2006	NS	<5.0	NA	NA	<4.0	<10	<25	NA	<3.0	<0.20	<40	<5.0	<10	NS	NA	163
	4/28/2006	NS	<8.0	NA	NA	<4.0	<10	<25	NA	3.8	<0.20	<40	<10	<10	NS	NA	114
	7/21/2006	<6.0	<8.0	NA	<1.0	<4.0	<10	<50	NA	<3.0	<0.20	<40	<10	NA	<10	NA	NS
	10/23/2006	NS	<8.0	NA	NA	<4.0	<10	<25	NA	3.1	<0.20	<40	<10	<10	NS	NA	179
	1/26/2007	NS	<8.0	NA	NA	<4.0	17.2	<25	NA	<3.0	<0.20	<40	<10	<10	NS	NA	163
	4/20/2007	NS	<8.0	NA	NA	<4.0	<10	<25	NA	<3.0	<0.20	<40	<10	<10	NS	NA	46.6
	7/27/2007	<6.0	<6.0	NA	<1.0	<4.0	<10	<25	NA	<3.0	<0.20	<40	<10	NA	<10	NA	NS
	10/30/2007	NS	<8.0	NA	NA	<4.0	<10	<25	NA	<3.0	<0.20	<40	<10	<10	NS	NA	104
	1/11/2008	NS	<8.0	NA	NA	<4.0	<10	<25	NA	**6.6**	<0.20	<40	<10	<10	NS	NA	105
	4/17/2008	NS	<8.0	NA	NA	<4.0	<10	<25	NA	<3.0	<0.20	<40	<10	<10	NS	NA	200
	7/22/2008	<6.0	<3.0	NA	<1.0	<4.0	<10	<25	NA	<3.0	<0.20	<40	<10	NA	<10	NA	NS
	10/29/2008	NS	<3.0	NA	NA	<3.0	<10	<10	NA	<3.0	<0.20	20.1	<10	<10	NS	NA	146
	1/22/2009	NS	<3.0	NA	NA	<3.0	<10	<10	NA	<3.0	<0.20	17.7	<10	<10	NS	NA	210
	4/29/2009	NS	<3.0	NA	NA	<3.0	<10	<10	NA	<3.0	<0.20	22.8	<10	<10	NS	NA	185
	7/29/2009	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	15.2	<10	NA	<10	NA	NS
	10/26/2009	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	18.4	<10	<10	<10	NA	161
	1/27/2010	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	13.4	<10	<10	<10	NA	155
	4/5/2010	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<10	NA	92.3
	7/22/2010	<6.0	<3.0	<200	<1.0	<3.0	<10	NA	<50	<3.0	<0.20	<10	<10	NA	NA	<50	NA
	10/25/2010	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<10	NA	150
	1/19/2011	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	15.6	<10	<10	<10	NA	106
	4/20/2011	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	15.8	<10	<10	<10	NA	156
	7/20/2011	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	16.9	<10	<10	<2.0	NA	237
	10/21/2011	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	79.2
	1/19/2012	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	11.3	<10	<10	<2.0	NA	125
	4/24/2012	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	50.8
	7/25/2012	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	11.3	<10	<10	<2.0	NA	112
	10/23/2012	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	0.23	10.0	<10	<10	<2.0	NA	70.7
	1/16/2013	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	21.2	<10	<10	<2.0	NA	150
	4/24/2013	<6.0	**8.7**	NA	<1.0	<3.0	19.7	29.8	NA	**32.8**	0.38	28.6	<10	<10	<2.0	NA	110
	7/24/2013	<6.0	**9.0**	<200	<1.0	<3.0	16.6	NA	<50	**31.4**	0.37	17.4	<10	NA	NA	<50	NA
	10/9/2013	<6.0	**8.7**	NA	<1.0	<3.0	22.2	27.4	NA	**39.3**	0.41	21.1	<10	<10	<2.0	NA	86.2
	1/15/2014	<6.0	**4.6**	NA	<1.0	<3.0	13.5	18.3	NA	**21.1**	<0.20	17.4	<10	<10	<2.0	NA	71.0
	4/23/2014	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	61.5
	7/23/2014	<6.0	<3.0	<200	<1.0	<3.0	<10	NA	<50	4.9	<0.20	<10	<10	NA	NA	<50	NA
	10/15/2014	<6.0	<3.0	NA	<1.0	<3.0	<10	13.7	NA	**9.4**	<0.20	11.3	<10	<10	<2.0	NA	44.0
	1/21/2015	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	23.6
	4/24/2015	<6.0	<3.0	NA	<1.0	<3.0	<10	10.4	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	45.6

ND - Not Detected
NA - Not Analyzed or Not Applicable
J - Estimated Value

Values in **bold** indicate compound above applicable NJDEP GWQS
GWQS - Groundwater Quality Standard
All data is reported in ug/L unless otherwise noted

Table 3c - Groundwater Data
No. 1 Landfarm
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

		Metals															
Sample ID	Date	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Copper	Cobalt	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
NJDEP GWQS		6	3	6,000	1	4	70	1,300	100	5	2	100	40	40	2	NA	2,000
Maximum Conc.		ND	**19.7**	550	ND	ND	ND	22.2	ND	**6.8**	ND	18.9	5.4	ND	ND	ND	47.4
L1-2	1/21/2005	NS	<5.0	NA	NA	<4.0	<10	<25	NA	<3.0	<0.20	<40	<5.0	<10	NA	NA	<20
	4/28/2005	NS	<5.0	NA	NA	<4.0	<10	<25	NA	<3.0	<0.20	<40	5.4	<10	NA	NA	<20
	7/22/2005	<5.0	<5.0	NA	<5.0	<4.0	<10	<25	NA	<3.0	<0.20	<40	<5.0	NS	<10	NA	NS
	10/28/2005	NS	<5.0	NA	NA	<4.0	<10	<25	NA	3.6	<0.20	<40	<5.0	<10	NA	NA	<20
	1/20/2006	NS	<5.0	NA	NA	<4.0	<10	<25	NA	4.7	<0.20	<40	<5.0	<10	NA	NA	<20
	4/28/2006	NS	<8.0	NA	NA	<4.0	<10	<25	NA	<3.0	<0.20	<40	<10	<10	NA	NA	<20
	7/21/2006	<6.0	<8.0	NA	<1.0	<4.0	<10	<50	NA	<3.0	<0.20	<40	<10	NS	<10	NA	NS
	10/23/2006	NS	<8.0	NA	NA	<4.0	<10	<25	NA	**6.8**	<0.20	<40	<10	<10	NA	NA	<20
	1/26/2007	NS	<8.0	NA	NA	<4.0	<10	<25	NA	<3.0	<0.20	<40	<10	<10	NA	NA	<20
	4/20/2007	NS	<8.0	NA	NA	<4.0	<10	<25	NA	<3.0	<0.20	<40	<10	<10	NA	NA	<20
	7/27/2007	<6.0	<6.0	NA	<1.0	<4.0	<10	<25	NA	<3.0	<0.20	<40	<10	NS	<10	NA	NS
	10/30/2007	NS	<8.0	NA	NA	<4.0	<10	<25	NA	<3.0	<0.20	<40	<10	<10	NA	NA	<20
	1/11/2008	NS	<8.0	NA	NA	<4.0	<10	<25	NA	<3.0	<0.20	<40	<10	<10	NA	NA	<20
	4/17/2008	NS	<8.0	NA	NA	<4.0	<10	<25	NA	<3.0	<0.20	<40	<10	<10	NA	NA	<20
	7/22/2008	<6.0	**6.6**	NA	<1.0	<4.0	<10	<25	NA	<3.0	<0.20	<40	<10	NS	<2.0	NA	NS
	10/29/2008	NS	**7.2**	NA	NA	<3.0	<10	<10	NA	<3.0	<0.20	18.9	<10	<10	NA	NA	<20
	1/22/2009	NS	**5.5**	NA	NA	<3.0	<10	18.0	NA	<3.0	<0.20	13.4	<10	<10	NA	NA	<20
	4/29/2009	NS	**4.6**	NA	NA	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	NA	NA	<20
	7/29/2009	<6.0	**5.8**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	NA	<10	NA	NS
	10/27/2009	<6.0	**7.4**	NA	<1.0	<3.0	<10	22.2	NA	4.2	<0.20	<10	<10	<10	<10	NA	47.4
	1/27/2010	<6.0	**4.2**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<10	NA	<20
	4/5/2010	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<10	NA	<20
	7/22/2010	<6.0	**11.6**	<200	<1.0	<3.0	<10	NS	<50	<3.0	<0.20	<10	<10	NA	NA	<50	NS
	10/25/2010	<6.0	**8.7**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<10	NA	<20
	1/19/2011	<6.0	**4.0**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<10	NA	<20
	4/20/2011	<6.0	**6.4**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<10	NA	<20
	7/20/2011	<6.0	**16.3**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	10/21/2011	<6.0	**19.7**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	1/19/2012	<6.0	**12.4**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	4/24/2012	<6.0	**3.0**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	7/25/2012	<6.0	**12.3**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	10/23/2012	<6.0	**4.4**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	1/16/2013	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	10.5	<10	<10	<2.0	NA	22.6
	4/24/2013	<6.0	**8.5**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	7/24/2013	<6.0	**8.5**	550	<1.0	<3.0	<10	NA	<50	4.5	<0.20	<10	<10	NA	NA	<50	NA
	10/9/2013	<6.0	**7.5**	NA	<1.0	<3.0	<10	<10	NA	**5.2**	<0.20	<10	<10	<10	<2.0	NA	<20
	1/15/2014	<6.0	**7.5**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	4/23/2014	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	7/23/2014	<6.0	**7.7**	<200	<1.0	<3.0	<10	NA	<50	<3.0	<0.20	<10	<10	NA	NA	<50	NA
	10/15/2014	<6.0	**9.8**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	1/21/2015	<6.0	**22.6**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	4/24/2015	<6.0	**139**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20

ND - Not Detected
NA - Not Analyzed or Not Applicable
J - Estimated Value

Values in **bold** indicate compound above applicable NJDEP GWQS
GWQS - Groundwater Quality Standard
All data is reported in ug/L unless otherwise noted

Table 3c - Groundwater Data
No. 1 Landfarm
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Sample ID	Date	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Copper	Cobalt	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
		Metals															
NJDEP GWQS		6	3	6,000	1	4	70	1,300	100	5	2	100	40	40	2	NA	2,000
Maximum Conc.		6	**168**	701	ND	3.3	15.5	31.6	ND	**32.6**	0.39	18	ND	ND	ND	ND	315
L1-3	1/21/2005	NS	**26.3**	NA	NA	<4.0	<10	<25	NA	<3.0	<0.20	<40	<5.0	<10	NA	NA	315
	5/4/2005	NS	**55.5**	NA	NA	<4.0	<10	<25	NA	<3.0	<0.20	<40	<5.0	<10	NA	NA	<20
	7/22/2005	6.0	**28.1**	NA	<5.0	<4.0	<10	<25	NA	<3.0	<0.20	<40	<5.0	<10	<10	NA	NS
	10/28/2005	NS	**168**	NA	NA	<4.0	<10	26.8	NA	**9.5**	<0.20	<40	<5.0	NS	NA	NA	88.9
	1/20/2006	NS	**134**	NA	NA	<4.0	<10	<25	NA	**8**	<0.20	<40	<5.0	<10	NA	NA	65.7
	4/28/2006	NS	**48.6**	NA	NA	<4.0	<10	<25	NA	<3.0	<0.20	<40	<10	<10	NA	NA	<20
	7/21/2006	<6.0	**32**	NA	<1.0	<4.0	<10	<50	NA	<3.0	<0.20	<40	<10	<10	<10	NA	NS
	10/23/2006	NS	**50**	NA	NA	<4.0	<10	<25	NA	**7.1**	<0.20	<40	<10	NS	NA	NA	39.5
	1/26/2007	NS	**29.8**	NA	NA	<4.0	15.5	<25	NA	<3.0	<0.20	<40	<10	<10	NA	NA	<20
	4/20/2007	NS	**19.1**	NA	NA	<4.0	<10	<25	NA	<3.0	<0.20	<40	<10	<10	NA	NA	<20
	7/27/2007	<6.0	**38.2**	NA	<1.0	<4.0	<10	<25	NA	<3.0	<0.20	<40	<10	<10	<10	NA	NS
	10/30/2007	NS	**34.7**	NA	NA	<4.0	<10	<25	NA	<3.0	<0.20	<40	<10	NA	NA	NA	21.9
	1/11/2008	NS	**64.2**	NA	NA	<4.0	<10	<25	NA	4.4	<0.20	<40	<10	<10	NA	NA	36.3
	4/17/2008	NS	**18.1**	NA	NA	<4.0	<10	<25	NA	<3.0	<0.20	<40	<10	<10	NA	NA	<20
	7/22/2008	<6.0	**40.9**	NA	<1.0	<4.0	<10	<25	NA	<3.0	<0.20	<40	<10	<10	<2.0	NA	NS
	10/29/2008	NS	**84.8**	NA	NA	<3.0	<10	10	NA	**7.1**	<0.20	15.9	<10	NS	NA	NA	88.3
	1/22/2009	NS	**44.9**	NA	NA	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	NA	NA	<20
	4/29/2009	NS	**25.1**	NA	NA	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	NA	NA	<20
	7/29/2009	<6.0	**49.2**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<10	NA	NS
	10/26/2009	<6.0	**40.2**	NA	<1.0	3.3	<10	<10	NA	<3.0	<0.20	15.1	<10	NS	<10	NA	23.9
	1/27/2010	<6.0	**19.6**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<10	NA	<20
	4/5/2010	<6.0	**31.7**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<5	NA	<20
	7/22/2010	<6.0	**28.5**	260	<1.0	<3.0	<10	NS	<50	<3.0	<0.20	<10	<10	<10	NA	<50	NS
	10/25/2010	<6.0	**27.9**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	NS	<5	NA	<20
	1/19/2011	Could not locate due to snow.															
	4/20/2011	<6.0	**15.2**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<5.0	NA	<20
	7/20/2011	<6.0	**34.0**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	10/21/2011	<6.0	**29.3**	NA	<1.0	<3.0	<10	<10	NA	<3.0	0.39	<10	<10	<10	<2.0	NA	<20
	1/19/2012	<6.0	**63.3**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	28.0
	4/24/2012	<6.0	**27.0**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	7/25/2012	<6.0	**30.5**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	10/23/2012	<6.0	**27.7**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	1/16/2013	<6.0	**35.9**	NA	<1.0	<3.0	<10	13.6	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	26.9
	4/24/2013	<6.0	**85.6**	NA	<1.0	<3.0	<10	13.4	NA	4.7	<0.20	<10	<10	<10	<2.0	NA	53.7
	7/24/2013	<6.0	**8.9**	701	<1.0	<3.0	<10	NA	<50	**6.3**	<0.20	18.0	<10	NA	NA	<50	NA
	10/9/2013	<6.0	**24.4**	NA	<1.0	<3.0	<10	<10	NA	4.2	<0.20	12.6	<10	<10	<2.0	NA	31.4
	1/15/2014	<6.0	**77.5**	NA	<1.0	<3.0	<10	21.6	NA	**14.0**	<0.20	15.8	<10	<10	<2.0	NA	68.4
	4/23/2014	<6.0	**12.8**	NA	<1.0	<3.0	<10	19.7	NA	**16.5**	<0.20	13.5	<10	<10	<2.0	NA	78.7
	7/23/2014	<6.0	**30.2**	433	<1.0	<3.0	12.5	NA	<50	**32.6**	0.33	<10	<10	NA	NA	<50	NA
	10/15/2014	<6.0	**42.1**	NA	<1.0	<3.0	10.1	31.6	NA	**15.4**	<0.20	<10	<10	<10	<2.0	NA	54.1
	1/21/2015	<6.0	**19.2**	NA	<1.0	<3.0	<10	<10	NA	3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	4/24/2015	<6.0	**21.8**	NA	<1.0	<3.0	<10	<10	NA	3.9	<0.20	<10	<10	<10	<2.0	NA	<20

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GWQS - Groundwater Quality Standard
All data is reported in ug/L unless otherwise noted

Table 3c - Groundwater Data
No. 1 Landfarm
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Sample ID	Date	Metals: Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Copper	Cobalt	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
NJDEP GWQS		6	3	6,000	1	4	70	1,300	100	5	2	100	40	40	2	NA	2,000
Maximum Conc.		**9.5**	**78.2**	ND	ND	3.5	43.9	219	ND	**107**	**2.4**	39.6	24.2	ND	ND	ND	182
L1-4	1/21/2005	NS	<5.1	NA	NA	<4.0	<10	<25	NA	<3.0	<10	<40	8.2	<1	NA	NA	<20
	5/4/2005	NS	<5.0	NA	NA	<4.0	<10	<25	NA	4.2	<0.20	<40	<5.0	<10	NA	NA	<20
	7/22/2005	**6.4**	<5.0	NA	<5.0	<4.0	<10	<25	NA	<3.0	<0.20	<40	7	<10	<10	NA	NS
	10/28/2005	NS	<5.0	NA	NA	<4.0	<10	<25	NA	<3.0	<0.20	<40	5.9	NA	NA	NA	<20
	1/20/2006	NS	<5.0	NA	NA	<4.0	<10	<25	NA	<3.0	<0.20	<40	7.7	<10	NA	NA	<20
	4/28/2006	NS	<8.0	NA	NA	<4.0	<10	<25	NA	**7.9**	<0.20	<40	<10	<10	NA	NA	23.5
	7/21/2006	<6.0	<8.0	NA	<1.0	<4.0	<10	<50	NA	3.1	<0.20	<40	<10	<10	<10	NA	NS
	10/23/2006	NS	<8.0	NA	NA	<4.0	<10	<25	NA	4.2	<0.20	<40	<10	NA	NA	NA	<20
	1/26/2007	NS	<8.0	NA	NA	<4.0	13.2	<25	NA	4.7	<0.20	<40	<10	<10	NA	NA	<20
	4/20/2007	NS	<8.0	NA	NA	<4.0	<10	<25	NA	4.1	<0.20	<40	<10	<10	NA	NA	<20
	7/27/2007	<6.0	<6.0	NA	<1.0	<4.0	<10	<25	NA	<3.0	<0.20	<40	<10	<10	<10	NA	NS
	10/30/2007	NS	<8.0	NA	NA	<4.0	<10	37.7	NA	**17**	<0.20	<40	<10	NA	NA	NA	36.2
	1/11/2008	NS	**8.1**	NA	NA	<4.0	17.6	82.3	NA	**58.8**	0.26	<40	<10	<10	NA	NA	98.5
	4/17/2008	NS	<8.0	NA	NA	<4.0	<10	37.2	NA	**15.3**	<0.20	<40	<10	<10	NA	NA	28.4
	7/22/2008	**6.5**	**8.4**	NA	<1.0	<4..0	<10	<25	NA	**11.4**	<0.20	<40	<10	<10	<2.0	NA	NS
	10/29/2008	NS	**18.7**	NA	NA	<3.0	<10	37.2	NA	**10.4**	0.21	<10	<10	NA	NA	NA	50.6
	1/22/2009	NS	**16.6**	NA	NA	<3.0	<10	34.4	NA	**17.9**	0.23	<10	<10	<10	NA	NA	27.2
	4/29/2009	NS	**5.2**	NA	NA	<3.0	<10	35.8	NA	**11.9**	<0.20	<10	<10	<10	NA	NA	<20
	7/29/2009	<6.0	**5.6**	NA	<1.0	<3.0	<10	44.9	NA	**7.3**	<0.20	<10	<10	<10	<10	NA	NS
	10/26/2009	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	NA	<10	NA	<20
	1/27/2010	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<10	NA	<20
	4/5/2010	<6.0	<3.0	NA	<1.0	<3.0	<10	19.6	NA	3.3	<0.20	<10	<10	<10	<10	NA	<20
	7/22/2010	<6.0	<3.0	<200	<1.0	<3.0	<10	NS	<50	<3.0	<0.20	<10	<10	<10	NA	<50	NS
	10/25/2010	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	NA	<10	NA	<20
	1/19/2011	Could not locate due to snow.															
	4/20/2011	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	3.1	<0.20	<10	<10	<10	<10	NA	<20
	7/20/2011	<6.0	**4.9**	NA	<1.0	<3.0	<10	<10	NA	3.4	<0.20	<10	<10	<10	<2.0	NA	<20
	10/21/2011	<6.0	**3.3**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	1/19/2012	<6.0	**73.3**	NA	<1.0	<3.0	<10	50.8	NA	**19.2**	0.55	<10	<10	<10	<2.0	NA	33.9
	4/24/2012	<6.0	**12.7**	NA	<1.0	<3.0	<10	<10	NA	4.5	0.21	<10	<10	<10	<2.0	NA	<20
	7/25/2012	<6.0	**8.5**	NA	<1.0	<3.0	<10	<10	NA	4.5	0.21	<10	<10	<10	<2.0	NA	<20
	10/23/2012	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	1/16/2013	<6.0	**56.1**	NA	<1.0	<3.0	<10	53.9	NA	**23.3**[a]	0.35	17.7	<10	<10	<10[a]	NA	38.6
	4/24/2013.	<6.0	**32.0**	NA	<1.0	<3.0	<10	84.7	NA	**19.6**	0.57	11.0	<10	<10	<2.0	NA	41.0
	7/24/2013	<6.0	**8.4**	<200	<1.0	<3.0	<10	NA	<50	**9.3**	0.31	<10	<10	NA	NA	<50	NA
	10/9/2013	<6.0	**4.1**	NA	<1.0	<3.0	<10	<10	NA	**5.7**	<0.20	<10	<10	<10	<2.0	NA	<20
	1/15/2014	**8.7**	**25.8**	NA	<1.0	<3.0	27.6	110	NA	**42.0**	0.77	16.6	24.2	<10	<2.0	NA	73.1
	4/23/2014	<6.0	**9.8**	NA	<1.0	<3.0	14.4	49.0	NA	**19.7**	0.43	13.6	<10	<10	<2.0	NA	47.5
	7/23/2014	<6.0	**13.7**	<200	<1.0	<3.0	<10	NA	<50	**16.3**	<0.20	<10	<10	NA	NA	<50	NA
	10/15/2014	**9.5**	**78.2**	NA	<1.0	3.5	43.9	219	NA	**107**	**2.4**	39.6	15.2	<10	<2.0	NA	182
	1/21/2015	<6.0	**4.5**	NA	<1.0	<3.0	<10	17.4	NA	**9.7**	<0.20	<10	<10	<10	<2.0	NA	<20
	4/24/2015	<6.0	**6.2**	NA	<1.0	<3.0	<10	11.6	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20

ND - Not Detected
NA - Not Analyzed or Not Applicable
J - Estimated Value
a- Elevated Detection Limit due to dilution required for high interfering element

Values in **bold** indicate compound above applicable NJDEP GWQS
GWQS - Groundwater Quality Standard
All data is reported in ug/L unless otherwise noted

Table 3c - Groundwater Data
No. 1 Landfarm
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Sample ID	Date	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Copper	Cobalt	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
		Metals															
NJDEP GWQS		6	3	6,000	1	4	70	1,300	100	5	2	100	40	40	2	NA	2,000
Maximum Conc.		**6.9**	**11.7**	ND	ND	ND	ND	116	ND	**22.4**	ND	13.5	ND	ND	ND	ND	1,380
	1/21/2005	NA	<5.0	NA	NS	<4.0	<10	<25	NA	<3.0	<0.20	<40	<5.0	<10	NA	NA	<20
	4/28/2005	NA	**8.3**	NA	NS	<4.0	<10	<25	NA	<3.0	<0.20	<40	<5.0	<10	NA	NA	23.9
	7/22/2005	**6.9**	**5.6**	NA	<5.0	<4.0	<10	<25	NA	<3.0	<0.20	<40	<5.0	<10	<10	NA	NS
	10/28/2005	NA	**7**	NA	NS	<4.0	<10	<25	NA	4.0	<0.20	<40	<5.0	NA	NA	NA	<20
	1/20/2006	NA	<5.0	NA	NS	<4.0	<10	<25	NA	3.6	<0.20	<40	<5.0	<10	NA	NA	<20
	4/28/2006	NA	<8.0	NA	NS	<4.0	<10	<25	NA	<3.0	<0.20	<40	<10	<10	NA	NA	<20
	7/21/2006	<6.0	<8.0	NA	<1.0	<4.0	<10	<50	NA	<3.0	<0.20	<40	<10	<10	<10	NA	NS
	10/23/2006	NA	<8.0	NA	NS	<4.0	<10	<25	NA	4.6	<0.20	<40	<10	NA	NA	NA	76.9
	1/26/2007	NA	<8.0	NA	NS	<4.0	<10	<25	NA	<3.0	<0.20	<40	<10	<10	NA	NA	<20
	4/20/2007	NA	<8.0	NA	NS	<4.0	<10	<25	NA	<3.0	<0.20	<40	<10	<10	NA	NA	<20
	7/27/2007	<6.0	<6.0	NA	<1.0	<4.0	<10	<25	NA	<3.0	<0.20	<40	<10	<10	<10	NA	NS
	10/30/2007	NA	<8.0	NA	NS	<4.0	<10	<25	NA	<3.0	<0.20	<40	<10	NA	NA	NA	<20
	1/11/2008	NA	<8.0	NA	NS	<4.0	<10	<25	NA	3.4	<0.20	<40	<10	<10	NA	NA	<20
	4/17/2008	NA	<8.0	NA	NS	<4.0	<10	<25	NA	<3.0	<0.20	<40	<10	<10	NA	NA	<20
	7/22/2008	<6.0	**7.5**	NA	<1.0	<4.0	<10	<50	NA	<3.0	<0.20	<40	<10	<10	<2.0	NA	NS
	10/29/2008	NA	**5.6**	NA	NS	<3.0	<10	116	NA	**22.4**	<0.20	13.5	<10	NS	NA	NA	1380
	1/22/2009	NA	**3.8**	NA	NS	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	NA	NS	<20
	4/29/2009	NA	**3.7**	NA	NS	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	NA	NA	<20
	7/29/2009	<6.0	**6.1**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<10	NA	NS
	10/26/2009	<6.0	**3.5**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	NA	<10	NA	<20
	1/27/2010	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<10	NA	<20
BG-2	4/5/2010	<6.0	**7.4**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<10	NA	<20
	7/22/2010	<6.0	<3.0	<200	<1.0	<3.0	<10	NA	<50	<3.0	<0.20	<10	<10	<10	NA	NA	NA
	10/25/2010	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	NS	<10	NA	<20
	1/19/2011	<6.0	**3.1**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<10	NA	<20
	4/20/2011	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<10	NA	<20
	7/20/2011	<6.0	**4.6**	<1.0	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	10/21/2011	<6.0	**5.7**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	1/19/2012	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	4/24/2012	<6.0	**5.1**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	7/25/2012	<6.0	**3.5**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	10/23/2012	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	1/16/2013	<6.0	**6.6**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	4/24/2013	<6.0	**9.0**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	7/24/2013	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	10/9/2013	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	1/15/2014	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	4/23/2014	<6.0	**4.1**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	7/23/2014	<6.0	**11.7**	<200	<1.0	<3.0	<10	NA	<50	<3.0	<0.20	<10	<10	NA	NA	<50	NA
	10/15/2014	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	1/21/2015	<6.0	**3.4**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	4/24/2015	<6.0	**8.1**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20

ND - Not Detected
NA - Not Analyzed or Not Applicable
J - Estimated Value

Values in **bold** indicate compound above applicable NJDEP GWQS
GWQS - Groundwater Quality Standard
All data is reported in ug/L unless otherwise noted

Table 3c - Groundwater Data
No. 1 Landfarm
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Sample ID	Date	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Copper	Cobalt	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
		Metals															
NJDEP GWQS		6	3	6,000	1	4	70	1,300	100	5	2	100	40	40	2	NA	2,000
Maximum Conc.		ND	**215**	291	ND	ND	ND	ND	ND	**7.2**	0.23	116	ND	ND	ND	ND	42
BG-3	*7/25/2012	<12	**215**	NA	<2	<6	<20	<20	NA	<6	<0.2	<20	<20	<10	<4	NA	<40
	10/23/2012	<6.0	**7.7**	NA	<1.0	<3.0	<10	<10	NA	<3.0	0.23	<10	<10	<20	<2.0	NA	<20
	1/16/2013	<6.0	<3.0	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	**116**	<10	<10	<2.0	NA	41.5
	4/24/2013	<6.0	**11.2**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	10.0	<10	<10	<2.0	NA	<20
	7/24/2013	<6.0	**9.4**	291	<1.0	<3.0	<10	NA	<50	**7.2**	<0.20	17.9	<10	NA	NA	<50	NA
	10/9/2013	<6.0	**24.3**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	14.2	<10	<10	<2.0	NA	<20
	1/15/2014	<6.0	3	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	4/23/2014	<6.0	**56**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	10.2	<10	<10	<2.0	NA	24.1
	7/23/2014	<6.0	<3.0	<200	<1.0	<3.0	<10	NA	<50	<3.0	<0.20	<10	<10	NA	NA	<50	NA
	10/15/2014	<6.0	**5.7**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	1/21/2015	<6.0	**3.4**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20
	4/24/2015	<6.0	**9.5**	NA	<1.0	<3.0	<10	<10	NA	<3.0	<0.20	<10	<10	<10	<2.0	NA	<20

ND - Not Detected
NA - Not Analyzed or Not Applicable
J - Estimated Value *Elevated sample results due to difficult matrix

Values in **bold** indicate compound above applicable NJDEP GWQS
GWQS - Groundwater Quality Standard
All data is reported in ug/L unless otherwise noted

Table 3d - Groundwater Data - General Chemistry
No. 1 Landfarm
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

General Chemistry					
Sample ID	Date	Cyanide (mg/l)	Nitrogen, Ammonia (mg/l)	Phenols (mg/l)	**pH
NJDEP GWQS		0.1	3	2,000	6.5-8.5
L1-1	1/21/2005	<0.010	NS	NS	NS
	4/28/2005	<0.010	NS	NS	NS
	7/22/2005	<0.010	NS	NS	NS
	10/28/2005	<0.010	NS	NS	NS
	1/20/2006	<0.010	NS	NS	NS
	4/28/2006	<0.010	NS	NS	NS
	7/21/2006	<0.010	NS	NS	NS
	10/23/2006	<0.010	NS	NS	NS
	1/26/2007	0.01	NS	NS	NS
	4/20/2007	<0.010	NS	NS	NS
	7/27/2007	<0.010	NS	NS	NS
	10/30/2007	<0.010	NS	NS	NS
	1/11/2008	<0.010	NS	NS	NS
	4/17/2008	<0.010	NS	NS	NS
	7/22/2008	<0.010	NS	NS	NS
	10/29/2008	<0.010	NS	NS	NS
	1/22/2009	<0.010	NS	NS	NS
	4/29/2009	<0.010	NS	NS	NS
	7/29/2009	<0.010	NS	NS	NS
	10/26/2009	0.016	NS	<0.20	NS
	1/27/2010	<0.010	NS	<0.20	NS
	4/5/2010	<0.010	NS	<0.20	NS
	7/22/2010	NS	NS	NS	NS
	10/25/2010	<0.010	NS	<0.20	NS
	1/19/2011	<0.010	NS	<0.20	NS
	4/20/2011	<0.010	NS	<0.20	NS
	7/20/2011	<0.010	NS	<0.20	NS
	10/21/2011	<0.010	NS	<0.20	NS
	1/19/2012	<0.010	NS	<0.20	**5.23**
	4/24/2012	NS	NS	ND *	**5.62**
	7/25/2012	<0.010	NS	<0.20	**4.86**
	10/23/2012	<0.010[1]	<0.20[1]	<0.20[1]	6.11
	1/16/2013	<0.010	<0.20	<0.20	**5.48**
	4/24/2013	<0.010	<0.20	<0.20	6.64
	7/24/2013	NA	NA	NA	6.74
	10/9/2013	<0.010	<0.20	<0.20	**5.51**
	1/15/2014	<0.010	<0.20	<0.20	**5.86**
	4/23/2014	0.013	<0.20	<0.20	**5.45**
	7/23/2014	NA	NA	NA	**5.35**
	10/15/2014	<0.010	<0.20	<0.20	**5.43**
	1/21/2015	<0.010	<0.20	<0.20	**4.74**
	4/24/2015	<0.010	<0.20	<0.20	**4.93**

All data reported in ug/l unless otherwise noted
Values in **bold** indicated an exceedance of the NJDEP GWQS
1- Storage Temperature Exceeded 6˚ Celsius due to power outage caused Tropical Cyclone Sandy (Oct 29-30 2012)

Table 3d - Groundwater Data - General Chemistry
No. 1 Landfarm
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

General Chemistry					
Sample ID	Date	Cyanide (mg/l)	Nitrogen, Ammonia (mg/l)	Phenols (mg/l)	**pH
NJDEP GWQS		0.1	3	2,000	6.5-8.5
L1-2	1/21/2005	<0.010	NS	NS	NS
	4/28/2005	<0.010	NS	NS	NS
	7/22/2005	<0.010	NS	NS	NS
	10/28/2005	<0.010	NS	NS	NS
	1/20/2006	<0.010	NS	NS	NS
	4/28/2006	<0.010	NS	NS	NS
	7/21/2006	<0.010	NS	NS	NS
	10/23/2006	<0.010	NS	NS	NS
	1/26/2007	<0.010	NS	NS	NS
	4/20/2007	<0.010	NS	NS	NS
	7/27/2007	<0.010	NS	NS	NS
	10/30/2007	<0.010	NS	NS	NS
	1/11/2008	<0.010	NS	NS	NS
	4/17/2008	<0.010	NS	NS	NS
	7/22/2008	<0.010	NS	NS	NS
	10/29/2008	<0.010	NS	NS	NS
	1/22/2009	<0.010	NS	NS	NS
	4/29/2009	<0.010	NS	NS	NS
	7/29/2009	<0.010	NS	NS	NS
	10/27/2009	<0.010	NS	<0.20	NS
	1/27/2010	<0.010	NS	<0.20	NS
	4/5/2010	<0.010	NS	<0.20	NS
	7/22/2010	NS	NS	NS	NS
	10/25/2010	<0.010	NS	<0.20	NS
	1/19/2011	0.04	NS	<0.20	NS
	4/20/2011	<0.010	NS	<0.20	NS
	7/20/2011	<0.010	NS	<0.20	NS
	10/21/2011	<0.010	NS	<0.20	NS
	1/19/2012	<0.010	NS	<0.20	**6.40**
	4/24/2012	NS	NS	<0.20	**6.35**
	7/25/2012	<0.010	NS	<0.20	**6.42**
	10/23/2012	<0.010[1]	2.1[1]	<0.20[1]	**6.29**
	1/16/2013	<0.010	0.88	<0.20	**6.08**
	4/24/2013	<0.010	1.5	<0.20	6.81
	7/24/2013	NA	NA	NA	**6.13**
	10/9/2013	<0.010	2.0	<0.20	**6.34**
	1/15/2014	<0.010	0.78	<0.20	**6.43**
	4/23/2014	0.01	0.59	<0.20	**6.39**
	7/23/2014	NA	NA	NA	**6.38**
	10/15/2014	<0.010	2.5	<0.20	6.50
	1/21/2015	<0.010	1.7	<0.20	**6.35**
	4/24/2015	<0.010	1.3	<0.20	**6.40**

All data reported in ug/l unless otherwise noted
Values in **bold** indicated an exceedance of the NJDEP GWQS
1- Storage Temperature Exceeded 6˚ Celsius due to power outage caused Tropical Cyclone Sandy (Oct 29-30 2012)

Table 3d - Groundwater Data - General Chemistry
No. 1 Landfarm
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

General Chemistry					
Sample ID	Date	Cyanide (mg/l)	Nitrogen, Ammonia (mg/l)	Phenols (mg/l)	**pH
NJDEP GWQS		0.1	3	2,000	6.5-8.5
L1-3	1/21/2005	<0.010	NS	NS	NS
	5/4/2005	0.082	NS	NS	NS
	7/22/2005	<0.010	NS	NS	NS
	10/28/2005	<0.010	NS	NS	NS
	1/20/2006	<0.010	NS	NS	NS
	4/28/2006	<0.010	NS	NS	NS
	7/21/2006	<0.010	NS	NS	NS
	10/23/2006	<0.010	NS	NS	NS
	1/26/2007	<0.010	NS	NS	NS
	4/20/2007	<0.010	NS	NS	NS
	7/27/2007	<0.010	NS	NS	NS
	10/30/2007	<0.010	NS	NS	NS
	1/11/2008	<0.010	NS	NS	NS
	4/17/2008	<0.010	NS	NS	NS
	7/22/2008	<0.010	NS	NS	NS
	10/29/2008	<0.010	NS	NS	NS
	1/22/2009	<0.010	NS	NS	NS
	4/29/2009	<0.010	NS	NS	NS
	7/29/2009	<0.010	NS	NS	NS
	10/26/2009	0.019	NS	<0.20	NS
	1/27/2010	<0.010	NS	<0.20	NS
	4/5/2010	<0.010	NS	<0.20	NS
	7/22/2010	NS	NS	NS	NS
	10/25/2010	<0.010	NS	<0.20	NS
	1/19/2011	Could not locate due to snow.			
	4/20/2011	<0.010	NS	<0.20	NS
	7/20/2011	<0.010	NS	<0.20	NS
	10/21/2011	<0.010	NS	<0.20	NS
	1/19/2012	<0.010	NS	<0.20	6.75
	4/24/2012	NS	NS	<0.20	6.73
	7/25/2012	<0.010	NS	<0.20	6.81
	10/23/2012	<0.010[1]	1.7[1]	<0.20[1]	6.83
	1/16/2013	<0.010	1.4	<0.20	6.85
	4/24/2013	<0.010	2.3	<0.20	**6.45**
	7/24/2013	NA	NA	NA	**6.21**
	10/9/2013	<0.010	2.7	<0.20	**5.71**
	1/15/2014	<0.010	2.5	<0.20	**5.83**
	4/23/2014	<0.010	<0.20	<0.20	**6.26**
	7/23/2014	NA	NA	NA	**6.19**
	10/15/2014	<0.010	2.6	<0.20	**6.28**
	1/21/2015	<0.010	1.8	<0.20	6.58
	4/24/2015	<0.010	1.6	<0.20	6.56

All data reported in ug/l unless otherwise noted
Values in **bold** indicated an exceedance of the NJDEP GWQS
1- Storage Temperature Exceeded 6° Celsius due to power outage caused Tropical Cyclone Sandy (Oct 29-30 2012)

Table 3d - Groundwater Data - General Chemistry
No. 1 Landfarm
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

General Chemistry					
Sample ID	Date	Cyanide (mg/l)	Nitrogen, Ammonia (mg/l)	Phenols (mg/l)	**pH
NJDEP GWQS		0.1	3	2,000	6.5-8.5
L1-4	1/21/2005	<0.010	NS	NS	NS
	5/4/2005	<0.010	NS	NS	NS
	7/22/2005	<0.010	NS	NS	NS
	10/28/2005	<0.010	NS	NS	NS
	1/20/2006	<0.010	NS	NS	NS
	4/28/2006	<0.010	NS	NS	NS
	7/21/2006	<0.010	NS	NS	NS
	10/23/2006	<0.010	NS	NS	NS
	1/26/2007	<0.010	NS	NS	NS
	4/20/2007	<0.010	NS	NS	NS
	7/27/2007	<0.010	NS	NS	NS
	10/30/2007	<0.010	NS	NS	NS
	1/11/2008	<0.010	NS	NS	NS
	4/17/2008	<0.010	NS	NS	NS
	7/22/2008	<0.010	NS	NS	NS
	10/29/2008	<0.010	NS	NS	NS
	1/22/2009	<0.010	NS	NS	NS
	4/29/2009	<0.010	NS	NS	NS
	7/29/2009	<0.010	NS	NS	NS
	10/26/2009	<0.010	NS	<0.20	NS
	1/27/2010	<0.010	NS	<0.20	NS
	4/5/2010	<0.010	NS	<0.20	NS
	7/22/2010	NS	NS	NS	NS
	10/25/2010	<0.010	NS	<0.20	NS
	1/19/2011	Could not locate due to snow.			
	4/20/2011	<0.010	NS	<0.20	NS
	7/20/2011	<0.010	NS	<0.20	NS
	10/21/2011	<0.010	NS	<0.20	NS
	1/19/2012	<0.010	NS	<0.20	6.68
	4/24/2012	NS	NS	<0.20	7.05
	7/25/2012	<0.010	NS	<0.20	6.94
	10/23/2012	<0.010[1]	2.1[1]	<0.20[1]	7.18
	1/16/2013	<0.010	0.30	<0.20	6.74
	4/24/2013	<0.010	0.65	<0.20	7.17
	7/24/2013	NA	NA	NA	6.88
	10/9/2013	<0.010	<0.20	<0.20	7.11
	1/15/2014	<0.010	<0.20	<0.20	7.44
	4/23/2014	<0.010	<0.20	<0.20	**6.26**
	7/23/2014	NA	NA	NA	7.10
	10/15/2014	<0.010	**4.4**	0.27	6.90
	1/21/2015	<0.010	<0.20	<0.20	7.21
	4/24/2015	<0.010	<0.20	<0.20	7.00

All data reported in ug/l unless otherwise noted
Values in **bold** indicated an exceedance of the NJDEP GWQS
1- Storage Temperature Exceeded 6˚ Celsius due to power outage caused Tropical Cyclone Sandy (Oct 29-30 2012)

Table 3d - Groundwater Data - General Chemistry
No. 1 Landfarm
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

General Chemistry					
Sample ID	Date	Cyanide (mg/l)	Nitrogen, Ammonia (mg/l)	Phenols (mg/l)	**pH
NJDEP GWQS		0.1	3	2,000	6.5-8.5
BG-2	1/21/2005	<0.010	NS	NS	NS
	4/28/2005	<0.010	NS	NS	NS
	7/22/2005	<0.010	NS	NS	NS
	10/28/2005	<0.010	NS	NS	NS
	1/20/2006	<0.010	NS	NS	NS
	4/28/2006	<0.010	NS	NS	NS
	7/21/2006	<0.010	NS	NS	NS
	10/23/2006	<0.010	NS	NS	NS
	1/26/2007	<0.010	NS	NS	NS
	4/20/2007	<0.010	NS	NS	NS
	7/27/2007	<0.010	NS	NS	NS
	10/30/2007	<0.010	NS	NS	NS
	1/11/2008	<0.010	NS	NS	NS
	4/17/2008	<0.010	NS	NS	NS
	7/22/2008	<0.010	NS	NS	NS
	10/29/2008	<0.010	NS	NS	NS
	1/22/2009	<0.010	NS	NS	NS
	4/29/2009	<0.010	NS	NS	NS
	7/29/2009	<0.010	NS	NS	NS
	10/26/2009	0.018	NS	<0.20	NS
	1/27/2010	<0.010	NS	<0.20	NS
	4/5/2010	<0.010	NS	<0.20	NS
	7/22/2010	NS	NS	NS	NS
	10/25/2010	<0.010	NS	<0.20	NS
	1/19/2011	<0.010	NS	<0.20	NS
	4/20/2011	<0.010	NS	<0.20	NS
	7/20/2011	<0.010	NS	<0.20	NS
	10/21/2011	<0.010	NS	<0.20	NS
	1/19/2012	<0.010	NS	<0.20	**5.23**
	4/24/2012	NS	NS	<0.20	**6.46**
	7/25/2012	<0.010	NS	<0.20	**5.01**
	10/23/2012	<0.010[1]	**7.1**[1]	<0.20[1]	**6.31**
	1/16/2013	<0.010	0.54	<0.20	**6.31**
	4/24/2013	<0.010	0.28	<0.2	**6.45**
	7/24/2013	NS	NS	NS	NS
	10/9/2013	NS	NS	NS	NS
	1/15/2014	<0.010	<0.20	<0.020	6.68
	4/23/2014	<0.010	<0.20	<0.20	6.89
	7/23/2014	NA	NA	NA	**6.33**
	10/15/2014	<0.010	**4.6**	<0.20	**6.10**
	1/21/2015	<0.010	0.27	<0.20	6.75
	4/24/2015	<0.010	<0.20	<0.20	6.57

All data reported in ug/l unless otherwise noted
Values in **bold** indicated an exceedance of the NJDEP GWQS
1- Storage Temperature Exceeded 6° Celsius due to power outage caused Tropical Cyclone Sandy (Oct 29-30 2012)

Table 3d - Groundwater Data - General Chemistry
No. 1 Landfarm
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

General Chemistry					
Sample ID	Date	Cyanide (mg/l)	Nitrogen, Ammonia (mg/l)	Phenols (mg/l)	**pH
NJDEP GWQS		0.1	3	2,000	6.5-8.5
BG-3	7/25/2012	<0.010	NS	<0.20	**6.11**
	10/23/2012	<0.010[1]	<0.20[1]	<0.20[1]	7.34
	1/16/2013	<0.010	0.92	<0.20	**3.51**
	4/24/2013	<0.010	0.28	<0.20	6.80
	7/24/2013	NA	NA	NA	6.70
	10/9/2013	<0.010	0.67	<0.20	**6.20**
	1/15/2014	<0.010	<0.20	<0.20	**6.09**
	4/23/2014	<0.010	0.23	<0.20	6.63
	7/23/2014	NA	NA	NA	6.97
	10/15/2014	<0.010	0.31	<0.20	**6.32**
	1/21/2015	<0.010	<0.20	<0.20	**6.47**
	4/24/2015	<0.010	<0.20	<0.20	**6.16**

All data reported in ug/l unless otherwise noted
Values in **bold** indicated an exceedance of the NJDEP GWQS
1- Storage Temperature Exceeded 6° Celsius due to power outage caused Tropical Cyclone Sandy (Oct 29-30 2012)

Table 3e

Hess Corporation - Former Port Reading Complex - 750 Cliff Road, Port Reading, New Jersey

No. 1 Landfarm - 2015 Groundwater Analytical Results

Client Sample ID:		NJ Groundwater Criteria (NJAC 7:9C 7/07)[1]	NJ Interim Groundwater Criteria (NJAC 7:9C 11/15)[2]	L1-1	L1-2	L1-3	L1-4	BG-2	BG-3	L1-1	L1-2	L1-3	L1-4	BG-2	BG-3
Lab Sample ID:				JC709-1	JC709-2	JC709-3	JC709-4	JC709-5	JC709-6	JC7262-1	JC7262-2	JC7262-3	JC7262-4	JC7262-5	JC7262-6
Date Sampled:				8/3/2015	8/3/2015	8/3/2015	8/3/2015	8/3/2015	8/3/2015	10/27/2015	10/27/2015	10/27/2015	10/27/2015	10/27/2015	10/27/2015
Matrix:				Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
GC/MS Volatiles (EPA 624)															
Acrolein	ug/l	5	-	ND (1.6)	ND (1.6)	ND (1.6)	ND (1.6)	ND (1.6)	ND (1.6)	-	-	-	-	-	-
Acrylonitrile	ug/l	2	-	ND (2.6)	ND (2.6)	ND (2.6)	ND (2.6)	ND (2.6)	ND (2.6)	-	-	-	-	-	-
Benzene	ug/l	1	-	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)
Bromodichloromethane	ug/l	1	-	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)
Bromoform	ug/l	4	-	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)	ND (0.17)
Bromomethane	ug/l	10	-	ND (0.57)	ND (0.57)	ND (0.57)	ND (0.57)	ND (0.57)	ND (0.57)	ND (0.57)	ND (0.57)	ND (0.57)	ND (0.57)	ND (0.57)	ND (0.57)
Carbon tetrachloride	ug/l	1	-	ND (0.096)	ND (0.096)	ND (0.096)	ND (0.096)	ND (0.096)	ND (0.096)	ND (0.096)	ND (0.096)	ND (0.096)	ND (0.096)	ND (0.096)	ND (0.096)
Chlorobenzene	ug/l	50	-	ND (0.093)	39.2	0.40 J	ND (0.093)	ND (0.093)	ND (0.093)	ND (0.093)	41.8	0.36 J	ND (0.093)	ND (0.093)	ND (0.093)
Chloroethane	ug/l	-	5	ND (0.21)	ND (0.21)	ND (0.21)	ND (0.21)	ND (0.21)	ND (0.21)	ND (0.21)	ND (0.21)	ND (0.21)	ND (0.21)	ND (0.21)	ND (0.21)
2-Chloroethyl vinyl ether	ug/l	-	-	ND (0.50)	ND (0.50)	ND (0.50)	ND (0.50)	ND (0.50)	ND (0.50)	ND (0.50)	ND (0.50)	ND (0.50)	ND (0.50)	ND (0.50)	ND (0.50)
Chloroform	ug/l	70	-	ND (0.091)	ND (0.091)	ND (0.091)	ND (0.091)	ND (0.091)	ND (0.091)	ND (0.091)	ND (0.091)	ND (0.091)	ND (0.091)	ND (0.091)	ND (0.091)
Chloromethane	ug/l	-	-	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)
Dibromochloromethane	ug/l	1	-	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)
1,2-Dichlorobenzene	ug/l	600	-	ND (0.19)	0.65 J	ND (0.19)	ND (0.19)	ND (0.19)	ND (0.19)	ND (0.19)	0.62 J	ND (0.19)	ND (0.19)	ND (0.19)	ND (0.19)
1,3-Dichlorobenzene	ug/l	600	-	ND (0.19)	0.82 J	ND (0.19)	ND (0.19)	ND (0.19)	ND (0.19)	ND (0.19)	0.74 J	ND (0.19)	ND (0.19)	ND (0.19)	ND (0.19)
1,4-Dichlorobenzene	ug/l	75	-	ND (0.11)	2.2	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)	2.1	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)
Dichlorodifluoromethane	ug/l	1000	-	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)
1,1-Dichloroethane	ug/l	50	-	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)
1,2-Dichloroethane	ug/l	2	-	ND (0.090)	ND (0.090)	ND (0.090)	ND (0.090)	ND (0.090)	ND (0.090)	ND (0.090)	ND (0.090)	ND (0.090)	ND (0.090)	ND (0.090)	ND (0.090)
1,1-Dichloroethene	ug/l	1	-	ND (0.16)	ND (0.16)	ND (0.16)	ND (0.16)	ND (0.16)	ND (0.16)	ND (0.16)	ND (0.16)	ND (0.16)	ND (0.16)	ND (0.16)	ND (0.16)
cis-1,2-Dichloroethene	ug/l	70	-	ND (0.12)	0.46 J	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	0.61 J	0.28 J	ND (0.12)	ND (0.12)	ND (0.12)
trans-1,2-Dichloroethene	ug/l	100	-	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)
1,2-Dichloropropane	ug/l	1	-	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)
cis-1,3-Dichloropropene	ug/l	-	-	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)
trans-1,3-Dichloropropene	ug/l	-	-	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)
Ethylbenzene	ug/l	700	-	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)
Methyl Tert Butyl Ether	ug/l	70	-	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	0.30 J	ND (0.12)
Methylene chloride	ug/l	3	-	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)
Tertiary Butyl Alcohol	ug/l	100	-	ND (2.5)	ND (2.5)	ND (2.5)	ND (2.5)	ND (2.5)	ND (2.5)	ND (2.5)	ND (2.5)	ND (2.5)	ND (2.5)	20.9 J	ND (2.5)
1,1,2,2-Tetrachloroethane	ug/l	1	-	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)
Tetrachloroethene	ug/l	1	-	0.30 J	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)	0.19 J	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)
Toluene	ug/l	600	-	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	0.28 J	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)
1,1,1-Trichloroethane	ug/l	30	-	ND (0.086)	ND (0.086)	ND (0.086)	ND (0.086)	ND (0.086)	ND (0.086)	ND (0.086)	ND (0.086)	ND (0.086)	ND (0.086)	ND (0.086)	ND (0.086)
1,1,2-Trichloroethane	ug/l	3	-	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)
Trichloroethene	ug/l	1	-	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)
Trichlorofluoromethane	ug/l	2000	-	ND (0.20)	ND (0.20)	ND (0.20)	ND (0.20)	ND (0.20)	ND (0.20)	ND (0.20)	ND (0.20)	ND (0.20)	ND (0.20)	ND (0.20)	ND (0.20)
Vinyl chloride	ug/l	1	-	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)
Xylenes (total)	ug/l	1000	-	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)
GC/MS Volatile TIC															
Total TIC, Volatile	ug/l	-	-	0	6.9 J	0	0	0	0	0	6.2 J	0	0	3.1 J	0
Total Alkanes	ug/l	-	-	0	0	0	0	0	0	0	0	0	0	0	0
GC/MS Semi-volatiles (EPA 625)															
2-Chlorophenol	ug/l	40	-	ND (1.0)	ND (0.95)	ND (1.1)	ND (1.1)	ND (1.0)	ND (0.95)	ND (1.1)	ND (1.0)	ND (0.95)	ND (0.95)	ND (0.95)	ND (1.0)
4-Chloro-3-methyl phenol	ug/l	-	100	ND (1.3)	ND (1.2)	ND (1.3)	ND (1.3)	ND (1.2)	ND (1.2)	ND (1.3)	ND (1.3)	ND (1.2)	ND (1.2)	ND (1.2)	ND (1.3)
2,4-Dichlorophenol	ug/l	20	-	ND (1.7)	ND (1.6)	ND (1.7)	ND (1.7)	ND (1.6)	ND (1.6)	ND (1.8)	ND (1.7)	ND (1.6)	ND (1.6)	ND (1.6)	ND (1.7)
2,4-Dimethylphenol	ug/l	100	-	ND (1.8)	ND (1.6)	ND (1.8)	ND (1.8)	ND (1.7)	ND (1.6)	ND (1.8)	ND (1.8)	ND (1.6)	ND (1.6)	ND (1.6)	ND (1.7)
2,4-Dinitrophenol	ug/l	40	-	ND (0.96)	ND (0.89)	ND (0.99)	ND (0.99)	ND (0.94)	ND (0.89)	ND (1.0)	ND (0.98)	ND (0.89)	ND (0.89)	ND (0.89)	ND (0.95)
4,6-Dinitro-o-cresol	ug/l	-	1	ND (0.78)	ND (0.72)	ND (0.80)	ND (0.80)	ND (0.76)	ND (0.72)	ND (0.81)	ND (0.79)	ND (0.72)	ND (0.72)	ND (0.72)	ND (0.77)
2-Nitrophenol	ug/l	-	-	ND (2.0)	ND (1.8)	ND (2.0)	ND (2.0)	ND (1.9)	ND (1.8)	ND (2.0)	ND (2.0)	ND (1.8)	ND (1.8)	ND (1.8)	ND (1.9)
4-Nitrophenol	ug/l	-	-	ND (0.91)	ND (0.84)	ND (0.94)	ND (0.94)	ND (0.89)	ND (0.84)	ND (0.95)	ND (0.93)	ND (0.84)	ND (0.84)	ND (0.84)	ND (0.90)
Pentachlorophenol	ug/l	0.3	-	ND (2.1)	ND (1.9)	ND (2.1)	ND (2.1)	ND (2.0)	ND (1.9)	ND (2.1)	ND (2.1)	ND (1.9)	ND (1.9)	ND (1.9)	ND (2.0)
Phenol	ug/l	2000	-	ND (0.54)	ND (0.50)	ND (0.55)	ND (0.55)	ND (0.52)	ND (0.50)	ND (0.56)	ND (0.55)	ND (0.50)	ND (0.50)	ND (0.50)	ND (0.53)
2,4,6-Trichlorophenol	ug/l	20	-	ND (1.4)	ND (1.3)	ND (1.4)	ND (1.4)	ND (1.3)	ND (1.3)	ND (1.4)	ND (1.4)	ND (1.3)	ND (1.3)	ND (1.3)	ND (1.3)
Acenaphthene	ug/l	400	-	ND (0.38)	ND (0.35)	0.66 J	ND (0.39)	ND (0.37)	ND (0.35)	ND (0.39)	ND (0.39)	ND (0.35)	ND (0.35)	ND (0.35)	ND (0.37)
Acenaphthylene	ug/l	-	100	ND (0.41)	ND (0.38)	ND (0.42)	ND (0.42)	ND (0.40)	ND (0.38)	ND (0.43)	ND (0.42)	ND (0.38)	ND (0.38)	ND (0.38)	ND (0.41)
Anthracene	ug/l	2000	-	ND (0.43)	ND (0.40)	ND (0.44)	ND (0.44)	ND (0.42)	ND (0.40)	ND (0.45)	ND (0.44)	ND (0.40)	ND (0.40)	ND (0.40)	ND (0.42)
Benzidine	ug/l	20	-	ND (0.30)	ND (0.28)	ND (0.31)	ND (0.31)	ND (0.29)	ND (0.28)	ND (0.31)	ND (0.31)	ND (0.28)	ND (0.28)	ND (0.28)	ND (0.30)
Benzo(a)anthracene	ug/l	0.1	-	ND (0.38)	ND (0.36)	ND (0.40)	ND (0.40)	ND (0.37)	ND (0.36)	ND (0.40)	ND (0.39)	ND (0.36)	ND (0.36)	ND (0.36)	ND (0.38)
Benzo(a)pyrene	ug/l	0.1	-	ND (0.40)	ND (0.37)	ND (0.41)	ND (0.41)	ND (0.39)	ND (0.37)	ND (0.41)	ND (0.40)	ND (0.37)	ND (0.37)	ND (0.37)	ND (0.39)
Benzo(b)fluoranthene	ug/l	0.2	-	ND (0.64)	ND (0.59)	ND (0.66)	ND (0.66)	ND (0.62)	ND (0.59)	ND (0.66)	ND (0.65)	ND (0.59)	ND (0.59)	ND (0.59)	ND (0.63)
Benzo(g,h,i)perylene	ug/l	-	100	ND (0.46)	ND (0.42)	ND (0.47)	ND (0.47)	ND (0.44)	ND (0.42)	ND (0.47)	ND (0.46)	ND (0.42)	ND (0.42)	ND (0.42)	ND (0.45)
Benzo(k)fluoranthene	ug/l	0.5	-	ND (0.46)	ND (0.42)	ND (0.47)	ND (0.47)	ND (0.44)	ND (0.42)	ND (0.47)	ND (0.46)	ND (0.42)	ND (0.42)	ND (0.42)	ND (0.45)
4-Bromophenyl phenyl ether	ug/l	-	-	ND (0.32)	ND (0.30)	ND (0.33)	ND (0.33)	ND (0.31)	ND (0.30)	ND (0.34)	ND (0.33)	ND (0.30)	ND (0.30)	ND (0.30)	ND (0.32)
Butyl benzyl phthalate	ug/l	100	-	ND (0.64)	ND (0.59)	ND (0.66)	ND (0.66)	ND (0.62)	ND (0.59)	ND (0.67)	ND (0.65)	ND (0.59)	ND (0.59)	ND (0.59)	ND (0.63)
2-Chloronaphthalene	ug/l	600	-	ND (1.1)	ND (0.98)	ND (1.1)	ND (1.1)	ND (1.0)	ND (0.98)	ND (1.1)	ND (1.1)	ND (0.98)	ND (0.98)	ND (0.98)	ND (1.0)
4-Chloroaniline	ug/l	30	-	ND (0.43)	ND (0.40)	ND (0.44)	ND (0.44)	ND (0.42)	ND (0.40)	ND (0.45)	ND (0.44)	ND (0.40)	ND (0.40)	ND (0.40)	ND (0.42)
Chrysene	ug/l	5	-	ND (0.27)	ND (0.25)	ND (0.28)	ND (0.28)	ND (0.26)	ND (0.25)	ND (0.28)	ND (0.27)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.27)
bis(2-Chloroethoxy)methane	ug/l	-	-	ND (0.71)	ND (0.65)	ND (0.73)	ND (0.73)	ND (0.69)	ND (0.65)	ND (0.73)	ND (0.72)	ND (0.65)	ND (0.65)	ND (0.65)	ND (0.70)
bis(2-Chloroethyl)ether	ug/l	7	-	ND (0.57)	ND (0.53)	ND (0.59)	ND (0.59)	ND (0.56)	ND (0.53)	ND (0.60)	ND (0.58)	ND (0.53)	ND (0.53)	ND (0.53)	ND (0.56)
bis(2-Chloroisopropyl)ether	ug/l	300	-	ND (0.80)	ND (0.74)	ND (0.82)	ND (0.82)	ND (0.78)	ND (0.74)	ND (0.83)	ND (0.81)	ND (0.74)	ND (0.74)	ND (0.74)	ND (0.79)
4-Chlorophenyl phenyl ether	ug/l	-	-	ND (0.47)	ND (0.43)	ND (0.48)	ND (0.48)	ND (0.45)	ND (0.43)	ND (0.48)	ND (0.47)	ND (0.43)	ND (0.43)	ND (0.43)	ND (0.46)
1,2-Dichlorobenzene	ug/l	600	-	ND (0.22)	0.55 J	ND (0.23)	ND (0.23)	ND (0.22)	ND (0.21)	ND (0.23)	ND (0.23)	ND (0.21)	ND (0.21)	ND (0.21)	ND (0.22)
1,2-Diphenylhydrazine	ug/l	20	-	ND (0.49)	ND (0.45)	ND (0.50)	ND (0.50)	ND (0.48)	ND (0.45)	ND (0.51)	ND (0.50)	ND (0.45)	ND (0.45)	ND (0.45)	ND (0.48)
1,3-Dichlorobenzene	ug/l	600	-	ND (0.17)	0.65 J	ND (0.18)	ND (0.18)	ND (0.17)	ND (0.16)	ND (0.18)	0.45 J	ND (0.16)	ND (0.16)	ND (0.16)	ND (0.17)
1,4-Dichlorobenzene	ug/l	75	-	ND (0.19)	1.7 J	ND (0.20)	ND (0.20)	ND (0.19)	ND (0.18)	ND (0.20)	1.2 J	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.19)
2,4-Dinitrotoluene	ug/l	-	-	ND (0.93)	ND (0.86)	ND (0.96)	ND (0.96)	ND (0.91)	ND (0.86)	ND (0.97)	ND (0.95)	ND (0.86)	ND (0.86)	ND (0.86)	ND (0.91)
2,6-Dinitrotoluene	ug/l	-	-	ND (0.60)	ND (0.56)	ND (0.62)	ND (0.62)	ND (0.59)	ND (0.56)	ND (0.63)	ND (0.61)	ND (0.56)	ND (0.56)	ND (0.56)	ND (0.59)
3,3'-Dichlorobenzidine	ug/l	30	-	ND (1.3)	ND (1.2)	ND (1.4)	ND (1.4)	ND (1.3)	ND (1.2)	ND (1.4)	ND (1.3)	ND (1.2)	ND (1.2)	ND (1.2)	ND (1.3)
Dibenzo(a,h)anthracene	ug/l	0.3	-	ND (0.59)	ND (0.54)	ND (0.60)	ND (0.60)	ND (0.57)	ND (0.54)	ND (0.61)	ND (0.60)	ND (0.54)	ND (0.54)	ND (0.54)	ND (0.58)
Di-n-butyl phthalate	ug/l	700	-	ND (0.64)	ND (0.59)	ND (0.66)	ND (0.66)	ND (0.62)	ND (0.59)	ND (0.67)	ND (0.65)	ND (0.59)	ND (0.59)	ND (0.59)	ND (0.63)
Di-n-octyl phthalate	ug/l	100	-	ND (0.62)	ND (0.57)	ND (0.63)	ND (0.63)	ND (0.60)	ND (0.57)	ND (0.64)	ND (0.63)	ND (0.57)	ND (0.57)	ND (0.57)	ND (0.61)
Diethyl phthalate	ug/l	6000	-	ND (0.42)	ND (0.39)	ND (0.43)	ND (0.43)	ND (0.41)	ND (0.39)	ND (0.44)	ND (0.43)	ND (0.39)	ND (0.39)	ND (0.39)	ND (0.41)
Dimethyl phthalate	ug/l	-	100	ND (0.35)	ND (0.33)	ND (0.36)	ND (0.36)	ND (0.35)	ND (0.33)	ND (0.37)	ND (0.36)	ND (0.33)	ND (0.33)	ND (0.33)	ND (0.35)
bis(2-Ethylhexyl)phthalate	ug/l	3	-	ND (0.71)	**4.1**	ND (0.73)	ND (0.73)	ND (0.70)	ND (0.66)	ND (0.74)	ND (0.73)	ND (0.66)	1.1 J	ND (0.66)	ND (0.70)
Fluoranthene	ug/l	300	-	ND (0.27)	ND (0.25)	ND (0.28)	ND (0.28)	ND (0.26)	ND (0.25)	ND (0.28)	ND (0.27)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.26)
Fluorene	ug/l	300	-	ND (0.49)	ND (0.45)	ND (0.50)	ND (0.50)	ND (0.47)	ND (0.45)	ND (0.50)	ND (0.49)	ND (0.45)	ND (0.45)	ND (0.45)	ND (0.48)
Hexachlorobenzene	ug/l	0.02	-	ND (0.58)	ND (0.54)	ND (0.60)	ND (0.60)	ND (0.57)	ND (0.54)	ND (0.60)	ND (0.59)	ND (0.54)	ND (0.54)	ND (0.54)	ND (0.57)
Hexachlorobutadiene	ug/l	1	-	ND (0.19)	ND (0.18)	ND (0.19)	ND (0.19)	ND (0.18)	ND (0.18)	ND (0.20)	ND (0.19)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.19)
Hexachlorocyclopentadiene	ug/l	40	-	ND (0.44)	ND (0.41)	ND (0.45)	ND (0.45)	ND (0.43)	ND (0.41)	ND (0.46)	ND (0.45)	ND (0.41)	ND (0.41)	ND (0.41)	ND (0.43)
Hexachloroethane	ug/l	7	-	ND (0.31)	ND (0.28)	ND (0.31)	ND (0.31)	ND (0.30)	ND (0.28)	ND (0.32)	ND (0.31)	ND (0.28)	ND (0.28)	ND (0.28)	ND (0.30)
Indeno(1,2,3-cd)pyrene	ug/l	0.2	-	ND (0.33)	ND (0.30)	ND (0.34)	ND (0.34)	ND (0.32)	ND (0.30)	ND (0.34)	ND (0.33)	ND (0.30)	ND (0.30)	ND (0.30)	ND (0.32)
Isophorone	ug/l	40	-	ND (0.64)	ND (0.59)	ND (0.65)	ND (0.65)	ND (0.62)	ND (0.59)	ND (0.66)	ND (0.65)	ND (0.59)	ND (0.59)	ND (0.59)	ND (0.63)
Naphthalene	ug/l	300	-	ND (0.35)	ND (0.32)	ND (0.36)	ND (0.36)	ND (0.34)	ND (0.32)	ND (0.36)	ND (0.35)	ND (0.32)	ND (0.32)	ND (0.32)	ND (0.34)
Nitrobenzene	ug/l	6	-	ND (0.45)	ND (0.42)	ND (0.47)	ND (0.47)	ND (0.44)	ND (0.42)	ND (0.47)	ND (0.46)	ND (0.42)	ND (0.42)	ND (0.42)	ND (0.45)
n-Nitrosodimethylamine	ug/l	0.8	-	ND (0.49)	ND (0.46)	ND (0.51)	ND (0.51)	ND (0.48)	ND (0.46)	ND (0.51)	ND (0.50)	ND (0.46)	ND (0.46)	ND (0.46)	ND (0.49)
N-Nitroso-di-n-propylamine	ug/l	10	-	ND (0.51)	ND (0.47)	ND (0.52)	ND (0.52)	ND (0.49)	ND (0.47)	ND (0.53)	ND (0.51)	ND (0.47)	ND (0.47)	ND (0.47)	ND (0.50)
N-Nitrosodiphenylamine	ug/l	10	-	ND (0.56)	ND (0.52)	ND (0.57)	ND (0.57)	ND (0.54)	ND (0.52)	ND (0.58)	ND (0.57)	ND (0.52)	ND (0.52)	ND (0.52)	ND (0.55)
Phenanthrene	ug/l	-	-	ND (0.39)	ND (0.36)	ND (0.40)	ND (0.40)	ND (0.38)	ND (0.36)	ND (0.41)	ND (0.40)	ND (0.36)	ND (0.36)	ND (0.36)	ND (0.39)
Pyrene	ug/l	200	-	ND (0.36)	ND (0.34)	ND (0.37)	ND (0.37)	ND (0.35)	ND (0.34)	ND (0.38)	ND (0.37)	ND (0.34)	ND (0.34)	ND (0.34)	ND (0.36)
1,2,4-Trichlorobenzene	ug/l	9	-	ND (0.37)	ND (0.34)	ND (0.38)	ND (0.38)	ND (0.36)	ND (0.34)	ND (0.38)	ND (0.37)	ND (0.34)	ND (0.34)	ND (0.34)	ND (0.36)
GC/MS Semi-volatile TIC															
Total TIC, Semi-Volatile	ug/l	-	-	95 J	38.5 J	0	27 J	31 J	19.9 J	0	9 J	0	0	7.6 J	0
Total Alkanes	ug/l	-	-	0	0	0	0	0	0	0	0	0	0	0	0
Metals Analysis															
Antimony	ug/l	6	-	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0
Arsenic	ug/l	3	-	<3.0	**29.5**	**28.4**	<3.0	**4.3**	**13.8**	<3.0	**38.9**	**28.2**	<3.0	<3.0	**9.1**
Beryllium	ug/l	1	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	ug/l	4	-	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Chromium	ug/l	70	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Copper	ug/l	1300	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Lead	ug/l	5	-	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Mercury	ug/l	2	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Nickel	ug/l	100	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Selenium	ug/l	40	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Silver	ug/l	40	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Thallium	ug/l	2	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Zinc	ug/l	2000	-	<20	<20	<20	<20	<20	<20	21.1	<20	<20	<20	<20	<20
General Chemistry															
Cyanide	mg/l	0.1	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen, Ammonia	mg/l	3	-	<0.20	1.7	1.9	<0.20	1.3	0.48	<0.20	1.6	1.2	<0.20	1.9	0.21
Phenols	mg/l	-	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
pH	su	6.5-8.5	-	**4.64** [a]	**6.36** [a]	**5.70** [a]	6.53 [a]	**5.71** [a]	**6.22** [a]	**4.65** [a]	**5.78** [a]	**6.43** [a]	6.52 [a]	**6.41** [a]	**5.55** [a]

Table 3f
Hess Corporation - Port Reading Complex (HC-PR)
Quarterly Sampling Groundwater Analytical Results - No. 1 Landfarm

			SAMPLE ID:	L1-1				L1-2				L1-3				L1-4				BG-2				BG-3				FB				TRIP BLANK			
			LAB ID:	L1601393-01				L1601393-02				L1601393-03				L1601393-04				L1601393-05				L1601393-06				L1601393-07				L1601393-08			
			COLLECTION DATE:	1/15/2016				1/15/2016				1/15/2016				1/15/2016				1/15/2016				1/15/2016				1/15/2016				1/14/2016			
			SAMPLE DEPTH:																																
			SAMPLE MATRIX:	WATER				WATER				WATER				WATER				WATER				WATER				WATER				WATER			
		NJ-GWIIA	NJ-INTGW																																
ANALYTE	CAS	(ug/l)	(ug/l)	Conc	Q	RL	MDL	Conc	Q	RL	MDL	Conc	Q	RL	MDL	Conc	Q	RL	MDL	Conc	Q	RL	MDL	Conc	Q	RL	MDL	Conc	Q	RL	MDL	Conc	Q	RL	MDL
VOLATILE ORGANICS BY GC/MS																																			
1,2-Dibromo-3-chloropropane	96-12-8	0.02	NA	ND		2.5	0.32	ND		2.5	0.32	ND		2.5	0.32	ND		2.5	0.32	ND		2.5	0.32	ND		2.5	0.32	ND		2.5	0.32	ND		2.5	0.32
1,4-Dioxane	123-91-1	NA	0.4	ND		250	41	ND		250	41	ND		250	41	ND		250	41	ND		250	41	ND		250	41	ND		250	41	ND		250	41
1,2-Dibromoethane	106-93-4	0.03	NA	ND		2	0.1	ND		2	0.1	ND		2	0.1	ND		2	0.1	ND		2	0.1	ND		2	0.1	ND		2	0.1	ND		2	0.1
Methylene chloride	75-09-2	3	NA	ND		2.5	0.27	ND		2.5	0.27	ND		2.5	0.27	ND		2.5	0.27	ND		2.5	0.27	ND		2.5	0.27	ND		2.5	0.27	ND		2.5	0.27
1,1-Dichloroethane	75-34-3	50	NA	ND		0.75	0.21	ND		0.75	0.21	ND		0.75	0.21	ND		0.75	0.21	ND		0.75	0.21	ND		0.75	0.21	ND		0.75	0.21	ND		0.75	0.21
Chloroform	67-66-3	70	NA	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16
Carbon tetrachloride	56-23-5	1	NA	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1
1,2-Dichloropropane	78-87-5	1	NA	ND		1	0.11	ND		1	0.11	ND		1	0.11	ND		1	0.11	ND		1	0.11	ND		1	0.11	ND		1	0.11	ND		1	0.11
Dibromochloromethane	124-48-1	1	NA	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15
1,1,2-Trichloroethane	79-00-5	3	NA	ND		0.75	0.09	ND		0.75	0.09	ND		0.75	0.09	ND		0.75	0.09	ND		0.75	0.09	ND		0.75	0.09	ND		0.75	0.09	ND		0.75	0.09
Tetrachloroethene	127-18-4	1	NA	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09
Chlorobenzene	108-90-7	50	NA	ND		0.5	0.07	36		0.5	0.07	ND		0.5	0.07	ND		0.5	0.07	ND		0.5	0.07	ND		0.5	0.07	ND		0.5	0.07	ND		0.5	0.07
Trichlorofluoromethane	75-69-4	2000	NA	ND		2.5	0.1	ND		2.5	0.1	ND		2.5	0.1	ND		2.5	0.1	ND		2.5	0.1	ND		2.5	0.1	ND		2.5	0.1	ND		2.5	0.1
1,2-Dichloroethane	107-06-2	2	NA	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11
1,1,1-Trichloroethane	71-55-6	30	NA	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1
Bromodichloromethane	75-27-4	1	NA	ND		0.5	0.19	ND		0.5	0.19	ND		0.5	0.19	ND		0.5	0.19	ND		0.5	0.19	ND		0.5	0.19	ND		0.5	0.19	ND		0.5	0.19
trans-1,3-Dichloropropene	10061-02-6	1	NA	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15
cis-1,3-Dichloropropene	10061-01-5	1	NA	ND		0.5	0.14	ND		0.5	0.14	ND		0.5	0.14	ND		0.5	0.14	ND		0.5	0.14	ND		0.5	0.14	ND		0.5	0.14	ND		0.5	0.14
1,3-Dichloropropene, Total	542-75-6	NA	NA	ND		0.5	0.14	ND		0.5	0.14	ND		0.5	0.14	ND		0.5	0.14	ND		0.5	0.14	ND		0.5	0.14	ND		0.5	0.14	ND		0.5	0.14
Bromoform	75-25-2	4	NA	ND		2	0.25	ND		2	0.25	ND		2	0.25	ND		2	0.25	ND		2	0.25	ND		2	0.25	ND		2	0.25	ND		2	0.25
1,1,2,2-Tetrachloroethane	79-34-5	1	NA	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09
Benzene	71-43-2	1	NA	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09
Toluene	108-88-3	600	NA	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	0.28	J	0.75	0.16
Ethylbenzene	100-41-4	700	NA	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1
Chloromethane	74-87-3	NA	NA	ND		2.5	0.09	ND		2.5	0.09	ND		2.5	0.09	ND		2.5	0.09	ND		2.5	0.09	ND		2.5	0.09	ND		2.5	0.09	ND		2.5	0.09
Bromomethane	74-83-9	10	NA	ND		1	0.26	ND		1	0.26	ND		1	0.26	ND		1	0.26	ND		1	0.26	ND		1	0.26	ND		1	0.26	ND		1	0.26
Vinyl chloride	75-01-4	1	NA	ND		1	0.07	ND		1	0.07	ND		1	0.07	ND		1	0.07	ND		1	0.07	ND		1	0.07	ND		1	0.07	ND		1	0.07
Chloroethane	75-00-3	5	5	ND		1	0.13	ND		1	0.13	ND		1	0.13	ND		1	0.13	ND		1	0.13	ND		1	0.13	ND		1	0.13	ND		1	0.13
1,1-Dichloroethene	75-35-4	1	NA	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09
trans-1,2-Dichloroethene	156-60-5	100	NA	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16
Trichloroethene	79-01-6	1	NA	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11
1,2-Dichlorobenzene	95-50-1	600	NA	ND		2.5	0.07	0.61	J	2.5	0.07	ND		2.5	0.07	ND		2.5	0.07	ND		2.5	0.07	ND		2.5	0.07	ND		2.5	0.07	ND		2.5	0.07
1,3-Dichlorobenzene	541-73-1	600	NA	ND		2.5	0.07	0.73	J	2.5	0.07	ND		2.5	0.07	ND		2.5	0.07	ND		2.5	0.07	ND		2.5	0.07	ND		2.5	0.07	ND		2.5	0.07
1,4-Dichlorobenzene	106-46-7	75	NA	ND		2.5	0.08	1.9	J	2.5	0.08	ND		2.5	0.08	ND		2.5	0.08	ND		2.5	0.08	ND		2.5	0.08	ND		2.5	0.08	ND		2.5	0.08
Methyl tert butyl ether	1634-04-4	70	NA	ND		1	0.15	ND		1	0.15	ND		1	0.15	ND		1	0.15	ND		1	0.15	ND		1	0.15	ND		1	0.15	ND		1	0.15
p/m-Xylene	179601-23-1	NA	NA	ND		1	0.18	ND		1	0.18	ND		1	0.18	ND		1	0.18	ND		1	0.18	ND		1	0.18	ND		1	0.18	ND		1	0.18
o-Xylene	95-47-6	NA	NA	ND		1	0.17	ND		1	0.17	ND		1	0.17	ND		1	0.17	ND		1	0.17	ND		1	0.17	ND		1	0.17	ND		1	0.17
Xylene (Total)	1330-20-7	1000	NA	ND		1	0.17	ND		1	0.17	ND		1	0.17	ND		1	0.17	ND		1	0.17	ND		1	0.17	ND		1	0.17	ND		1	0.17
cis-1,2-Dichloroethene	156-59-2	70	NA	ND		0.5	0.11	0.36	J	0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11
1,2-Dichloroethene (total)	540-59-0	NA	NA	ND		0.5	0.11	0.36	J	0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11
Styrene	100-42-5	100	NA	ND		1	0.12	ND		1	0.12	ND		1	0.12	ND		1	0.12	ND		1	0.12	ND		1	0.12	ND		1	0.12	ND		1	0.12
Dichlorodifluoromethane	75-71-8	1000	NA	ND		5	0.19	ND		5	0.19	ND		5	0.19	ND		5	0.19	ND		5	0.19	ND		5	0.19	ND		5	0.19	ND		5	0.19
Acetone	67-64-1	6000	NA	ND		5	1.5	ND		5	1.5	ND		5	1.5	ND		5	1.5	ND		5	1.5	ND		5	1.5	ND		5	1.5	ND		5	1.5
Carbon disulfide	75-15-0	700	NA	0.57	J	5	0.09	0.61	J	5	0.09	0.52	J	5	0.09	ND		5	0.09	0.52	J	5	0.09	0.5	J	5	0.09	ND		5	0.09	ND		5	0.09
2-Butanone	78-93-3	300	NA	ND		5	1.9	ND		5	1.9	ND		5	1.9	ND		5	1.9	ND		5	1.9	ND		5	1.9	ND		5	1.9	ND		5	1.9
4-Methyl-2-pentanone	108-10-1	NA	NA	ND		5	0.26	ND		5	0.26	ND		5	0.26	ND		5	0.26	ND		5	0.26	ND		5	0.26	ND		5	0.26	ND		5	0.26
2-Hexanone	591-78-6	300	300	ND		5	0.14	ND		5	0.14	ND		5	0.14	ND		5	0.14	ND		5	0.14	ND		5	0.14	ND		5	0.14	ND		5	0.14
Bromochloromethane	74-97-5	NA	NA	ND		2.5	0.13	ND		2.5	0.13	ND		2.5	0.13	ND		2.5	0.13	ND		2.5	0.13	ND		2.5	0.13	ND		2.5	0.13	ND		2.5	0.13
Isopropylbenzene	98-82-8	700	NA	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11
1,2,3-Trichlorobenzene	87-61-6	NA	NA	ND		2.5	0.12	ND		2.5	0.12	ND		2.5	0.12	ND		2.5	0.12	ND		2.5	0.12	ND		2.5	0.12	ND		2.5	0.12	ND		2.5	0.12
1,2,4-Trichlorobenzene	120-82-1	9	NA	ND		2.5	0.12	ND		2.5	0.12	ND		2.5	0.12	ND		2.5	0.12	ND		2.5	0.12	ND		2.5	0.12	ND		2.5	0.12	ND		2.5	0.12
Methyl Acetate	79-20-9	7000	NA	ND		2	0.23	ND		2	0.23	ND		2	0.23	ND		2	0.23	ND		2	0.23	ND		2	0.23	ND		2	0.23	ND		2	0.23
Cyclohexane	110-82-7	NA	NA	ND		10	0.27	ND		10	0.27	ND		10	0.27	ND		10	0.27	ND		10	0.27	ND		10	0.27	ND		10	0.27	ND		10	0.27
Methyl cyclohexane	108-87-2	NA	NA	ND		10	0.4	ND		10	0.4	ND		10	0.4	ND		10	0.4	ND		10	0.4	ND		10	0.4	ND		10	0.4	ND		10	0.4
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	NA	20000	ND		2.5	0.15	ND		2.5	0.15	ND		2.5	0.15	ND		2.5	0.15	ND		2.5	0.15	ND		2.5	0.15	ND		2.5	0.15	ND		2.5	0.15
Total VOCs				0.57	-	-	-	40.57	-	-	-	0.52	-	-	-	-	-	-	-	0.52	-	-	-	0.5	-	-	-	-	-	-	-	0.28	-	-	-
VOLATILE ORGANICS BY GC/MS-TIC																																			
Unknown		NA	NA	-		-	-	-		-	-	-		-	-	1	J	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
No Tentatively Identified Compounds		NA	NA	ND		0	0	-		-	-	ND		0	0	-		-	-	ND		0	0	ND		0	0	ND		0	0	ND		0	0
Unknown Benzene		NA	NA	-		-	-	5.1	J	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total TIC Compounds		NA	NA	-		-	-	5.1	J	0	0	-		-	-	1	J	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SEMIVOLATILE ORGANICS BY GC/MS																																			
Acenaphthene	83-32-9	400	NA	ND		2	0.59	ND		2	0.59	ND		2	0.59	ND		2	0.59	ND		2	0.59	ND		2	0.59	ND		2	0.59	-	-	-	-
3-Methylphenol/4-Methylphenol	108-39-4	NA	NA	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	-	-	-	-
Bis(2-chloroethyl)ether	111-44-4	7	NA	ND		2	0.67	ND		2	0.67	ND		2	0.67	ND		2	0.67	ND		2	0.67	ND		2	0.67	ND		2	0.67	-	-	-	-
2-Chloronaphthalene	91-58-7	600	NA	ND		2	0.64	ND		2	0.64	ND		2	0.64	ND		2	0.64	ND		2	0.64	ND		2	0.64	ND		2	0.64	-	-	-	-
2,4-Dinitrotoluene	121-14-2	10	NA	ND		5	0.84	ND		5	0.84	ND		5	0.84	ND		5	0.84	ND		5	0.84	ND		5	0.84	ND		5	0.84	-	-	-	-
2,6-Dinitrotoluene	606-20-2	10	NA	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	-	-	-	-
Fluoranthene	206-44-0	300	NA	ND		2	0.57	ND		2	0.57	ND		2	0.57	ND		2	0.57	ND		2	0.57	ND		2	0.57	ND		2	0.57	-	-	-	-
4-Chlorophenyl phenyl ether	7005-72-3	NA	NA	ND		2	0.62	ND		2	0.62	ND		2	0.62	ND		2	0.62	ND		2	0.62	ND		2	0.62	ND		2	0.62	-	-	-	-
Bis(2-chloroisopropyl)ether	108-60-1	300	NA	ND		2	0.7	ND		2	0.7	ND		2	0.7	ND		2	0.7	ND		2	0.7	ND		2	0.7	ND		2	0.7	-	-	-	-
Bis(2-chloroethoxy)methane	111-91-1	NA	NA	ND		5	0.63	ND		5	0.63	ND		5	0.63	ND		5	0.63	ND		5	0.63	ND		5	0.63	ND		5	0.63	-	-	-	-
Hexachlorocyclopentadiene	77-47-4	40	NA	ND		20	7.8	ND		20	7.8	ND		20	7.8	ND		20	7.8	ND		20	7.8	ND		20	7.8	ND		20	7.8	-	-	-	-
Hexachloroethane	67-72-1	7	NA	ND		2	0.68	ND		2	0.68	ND		2	0.68	ND		2	0.68	ND		2	0.68	ND		2	0.68	ND		2	0.68	-	-	-	-
Isophorone	78-59-1	40	NA	ND		5	0.6	ND		5	0.6	ND		5	0.6	ND		5	0.6	ND		5	0.6	ND		5	0.6	ND		5	0.6	-	-	-	-
Naphthalene	91-20-3	300	NA	ND		2	0.68	ND		2	0.68	ND		2	0.68	ND		2	0.68	ND		2	0.68	ND		2	0.68	ND		2	0.68	-	-	-	-
Nitrobenzene	98-95-3	6	NA	ND		2	0.75	ND		2	0.75	ND		2	0.75	ND		2	0.75	ND		2	0.75	ND		2	0.75	ND		2	0.75	-	-	-	-
NitrosoDiPhenylAmine(NDPA)/DPA	86-30-6	10	NA	ND		2	0.64	ND		2	0.64	ND		2	0.64	ND		2	0.64	ND		2	0.64	ND		2	0.64	ND		2	0.64	-	-	-	-
n-Nitrosodi-n-propylamine	621-64-7	NA	NA	ND		5	0.7	ND		5	0.7	ND		5	0.7	ND		5	0.7	ND		5	0.7	ND		5	0.7	ND		5	0.7	-	-	-	-
Bis(2-Ethylhexyl)phthalate	117-81-7	3	NA	ND		3	0.91	ND		3	0.91	ND		3	0.91	ND		3	0.91	ND		3	0.91	ND		3	0.91	ND		3	0.91	-	-	-	-
Butyl benzyl phthalate	85-68-7	100	NA	ND		5	1.3	ND		5	1.3	ND		5	1.3	ND		5	1.3	ND		5	1.3	ND		5	1.3	ND		5	1.3	-	-	-	-
Di-n-butylphthalate	84-74-2	700	NA	ND		5	0.69	ND		5	0.69	ND		5	0.69	ND		5	0.69	ND		5	0.69	ND		5	0.69	ND		5	0.69	-	-	-	-
Di-n-octylphthalate	117-84-0	100	NA	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	-	-	-	-
Diethyl phthalate	84-66-2	6000	NA	ND		5	0.63	ND		5	0.63	ND		5	0.63	ND		5	0.63	ND		5	0.63	ND		5	0.63	ND		5	0.63	-	-	-	-
Dimethyl phthalate	131-11-3	100	100	ND		5	0.65	ND		5	0.65	ND		5	0.65	ND		5	0.65	ND		5	0.65	ND		5	0.65	ND		5	0.65	-	-	-	-
Chrysene	218-01-9	5	NA	ND		2	0.54	ND		2	0.54	ND		2	0.54	ND		2	0.54	ND		2	0.54	ND		2	0.54	ND		2	0.54	-	-	-	-
Acenaphthylene	208-96-8	NA	100	ND		2	0.66	ND		2	0.66	ND		2	0.66	ND		2	0.66	ND		2	0.66	ND		2	0.66	ND		2	0.66	-	-	-	-
Anthracene	120-12-7	2000	NA	ND		2	0.64	ND		2	0.64	ND		2	0.64	ND		2	0.64	ND		2	0.64	ND		2	0.64	ND		2	0.64	-	-	-	-
Benzo(ghi)perylene	191-24-2	100	100	ND		2	0.61	ND		2	0.61	ND		2	0.61	ND		2	0.61	ND		2	0.61	ND		2	0.61	ND		2	0.61	-	-	-	-
Fluorene	86-73-7	300	NA	ND		2	0.62	ND		2	0.62	ND		2	0.62	ND		2	0.62	ND		2	0.62	ND		2	0.62	ND		2	0.62	-	-	-	-
Phenanthrene	85-01-8	100	NA	ND		2	0.61	ND		2	0.61	ND		2	0.61	ND		2	0.61	ND		2	0.61	ND		2	0.61	ND		2	0.61	-	-	-	-
Pyrene	129-00-0	200	NA	ND		2	0.57	ND		2	0.57	ND		2	0.57	ND		2	0.57	ND		2	0.57	ND		2	0.57	ND		2	0.57	-	-	-	-
4-Chloroaniline	106-47-8	30	NA	ND		5	0.63	ND		5	0.63	ND		5	0.63	ND		5	0.63	ND		5	0.63	ND		5	0.63	ND		5	0.63	-	-	-	-
2-Nitroaniline	88-74-4	NA	NA	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	-	-	-	-
3-Nitroaniline	99-09-2	NA	NA	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	-	-	-	-
4-Nitroaniline	100-01-6	NA	NA	ND		5	1.3	ND		5	1.3	ND		5	1.3	ND		5	1.3	ND		5	1.3	ND		5	1.3	ND		5	1.3	-	-	-	-
Dibenzofuran	132-64-9	NA	NA	ND		2	0.66	ND		2	0.66	ND		2	0.66	ND		2	0.66	ND		2	0.66	ND		2	0.66	ND		2	0.66	-	-	-	-
2-Methylnaphthalene	91-57-6	30	30	ND		2	0.72	ND		2	0.72	ND		2	0.72	ND		2	0.72	ND		2	0.72	ND		2	0.72	ND		2	0.72	-	-	-	-
2,4,6-Trichlorophenol	88-06-2	20	NA	ND		5	0.68	ND		5	0.68	ND		5	0.68	ND		5	0.68	ND		5	0.68	ND		5	0.68	ND		5	0.68	-	-	-	-
P-Chloro-M-Cresol	59-50-7	100	100	ND		2	0.62	ND		2	0.62	ND		2	0.62	ND		2	0.62	ND		2	0.62	ND		2	0.62	ND		2	0.62	-	-	-	-
2-Chlorophenol	95-57-8	40	NA	ND		2	0.63	ND		2	0.63	ND		2	0.63	ND		2	0.63	ND		2	0.63	ND		2	0.63	ND		2	0.63	-	-	-	-
2,4-Dichlorophenol	120-83-2	20	NA	ND		5	0.77	ND		5	0.77	ND		5	0.77	ND		5	0.77	ND		5	0.77	ND		5	0.77	ND		5	0.77	-	-	-	-
2,4-Dimethylphenol	105-67-9	100	NA	ND		5	1.6	ND		5	1.6	ND		5	1.6	ND		5	1.6	ND		5	1.6	ND		5	1.6	ND		5	1.6	-	-	-	-
2-Nitrophenol	88-75-5	NA	NA	ND		10	1.5	ND		10	1.5	ND		10	1.5	ND		10	1.5	ND		10	1.5	ND		10	1.5	ND		10	1.5	-	-	-	-
4-Nitrophenol	100-02-7	NA	NA	ND		10	1.8	ND		10	1.8	ND		10	1.8	ND		10	1.8	ND		10	1.8	ND		10	1.8	ND		10	1.8	-	-	-	-
2,4-Dinitrophenol	51-28-5	40	NA	ND		20	5.5	ND		20	5.5	ND		20	5.5	ND		20	5.5	ND		20	5.5	ND		20	5.5	ND		20	5.5	-	-	-	-
Phenol	108-95-2	2000	NA	ND		5	1.9	ND		5	1.9	ND		5	1.9	ND		5	1.9	ND		5	1.9	ND		5	1.9	ND		5	1.9	-	-	-	-
2-Methylphenol	95-48-7	NA	50	ND		5	1	ND		5	1	ND		5	1	ND		5	1	ND		5	1	ND		5	1	ND		5	1	-	-	-	-
2,4,5-Trichlorophenol	95-95-4	700	NA	ND		5	0.72	ND		5	0.72	ND		5	0.72	ND		5	0.72	ND		5	0.72	ND		5	0.72	ND		5	0.72	-	-	-	-
Carbazole	86-74-8	NA	NA	ND		2	0.63	ND		2	0.63	ND		2	0.63	ND		2	0.63	ND		2	0.63	ND		2	0.63	ND		2	0.63	-	-	-	-
4-Bromophenyl phenyl ether	101-55-3	NA	NA	ND		2	0.73	ND		2	0.73	ND		2	0.73	ND		2	0.73	ND		2	0.73	ND		2	0.73	ND		2	0.73	-	-	-	-
3,3'-Dichlorobenzidine	91-94-1	30	NA	ND		5	1.4	ND		5	1.4	ND		5	1.4	ND		5	1.4	ND		5	1.4	ND		5	1.4	ND		5	1.4	-	-	-	-
Benzaldehyde	100-52-7	NA	NA	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	-	-	-	-
Acetophenone	98-86-2	700	NA	ND		5	0.85	ND		5	0.85	ND		5	0.85	ND		5	0.85	ND		5	0.85	ND		5	0.85	ND		5	0.85	-	-	-	-
Caprolactam	105-60-2	NA	5000	ND		10	3.6	ND		10	3.6	ND		10	3.6	ND		10	3.6	ND		10	3.6	ND		10	3.6	ND		10	3.6	-	-	-	-
Biphenyl	92-52-4	400	NA	ND		2	0.76	ND		2	0.76	ND		2	0.76	ND		2	0.76	ND		2	0.76	ND		2	0.76	ND		2	0.76	-	-	-	-
1,2,4,5-Tetrachlorobenzene	95-94-3	NA	NA	ND		10	0.67	ND		10	0.67	ND		10	0.67	ND		10	0.67	ND		10	0.67	ND		10	0.67	ND		10	0.67	-	-	-	-
Atrazine	1912-24-9	3	NA	ND		3	1.8	ND		3	1.8	ND		3	1.8	ND		3	1.8	ND		3	1.8	ND		3	1.8	ND		3	1.8	-	-	-	-
2,3,4,6-Tetrachlorophenol	58-90-2	200	NA	ND		5	0.93	ND		5	0.93	ND		5	0.93	ND		5	0.93	ND		5	0.93	ND		5	0.93	ND		5	0.93	-	-	-	-
Total SVOCs				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SEMIVOLATILE ORGANICS BY GC/MS-SIM																																			
4,6-Dinitro-o-cresol	534-52-1	NA	1	ND		1	1	ND		1	1	ND		1	1	ND		1	1	ND		1	1	ND		1	1	ND		1	1	-	-	-	-
Benzo(a)anthracene	56-55-3	0.1	NA	ND		0.1	0.08	ND		0.1	0.08	ND		0.1	0.08	ND		0.1	0.08	ND		0.1	0.08	ND		0.1	0.08	ND		0.1	0.08	-	-	-	-
Benzo(a)pyrene	50-32-8	0.1	NA	ND		0.1	0.03	ND		0.1	0.03	ND		0.1	0.03	ND		0.1	0.03	ND		0.1	0.03	ND		0.1	0.03	ND		0.1	0.03	-	-	-	-
Benzo(b)fluoranthene	205-99-2	0.2	NA	ND		0.2	0.06	ND		0.2	0.06	ND		0.2	0.06	ND		0.2	0.06	ND		0.2	0.06	ND		0.2	0.06	ND		0.2	0.06	-	-	-	-
Benzo(k)fluoranthene	207-08-9	0.5	NA	ND		0.2	0.06	ND		0.2	0.06	ND		0.2	0.06	ND		0.2	0.06	ND		0.2	0.06	ND		0.2	0.06	ND		0.2	0.06	-	-	-	-
Dibenzo(a,h)anthracene	53-70-3	0.3	NA	ND		0.2	0.04	ND		0.2	0.04	ND		0.2	0.04	ND		0.2	0.04	ND		0.2	0.04	ND		0.2	0.04	ND		0.2	0.04	-	-	-	-
Indeno(1,2,3-cd)Pyrene	193-39-5	0.2	NA	ND		0.2	0.14	ND		0.2	0.14	ND		0.2	0.14	ND		0.2	0.14	ND		0.2	0.14	ND		0.2	0.14	ND		0.2	0.14	-	-	-	-
Hexachlorobenzene	118-74-1	0.02	NA	ND		0.02	0.01	ND		0.02	0.01	ND		0.02	0.01	ND		0.02	0.01	ND		0.02	0.01	ND		0.02	0.01	ND		0.02	0.01	-	-	-	-
Pentachlorophenol	87-86-5	0.3	NA	ND		0.3	0.06	ND		0.3	0.06	ND		0.3	0.06	ND		0.3	0.06	ND		0.3	0.06	ND		0.3	0.06	ND		0.3	0.06	-	-	-	-
Hexachlorobutadiene	87-68-3	1	NA	ND		1	0.02	ND		1	0.02	ND		1	0.02	ND		1	0.02	ND		1	0.02	ND		1	0.02	ND		1	0.02	-	-	-	-
Total SVOCs				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SEMIVOLATILE ORGANICS BY GC/MS-TIC																																			
No Tentatively Identified Compounds		NA	NA	ND		0	0	ND		0	0	ND		0	0	ND		0	0	ND		0	0	ND		0	0	ND		0	0	-	-	-	-
Total SVOCs				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL METALS																																			
Antimony, Total	7440-36-0	6	NA	0.1622	J	2	0.0699	0.1732	J	2	0.0699	0.5909	J	2	0.0699	2.383		2	0.0699	0.1488	J	2	0.0699	0.848	J	2	0.0699	0.2407	J	2	0.0699	-	-	-	-
Arsenic, Total	7440-38-2	3	NA	0.2735	J	0.5	0.123	26.38		0.5	0.123	13.99		0.5	0.123	1.324		0.5	0.123	5.642		0.5	0.123	3.484		0.5	0.123	ND		0.5	0.123	-	-	-	-
Beryllium, Total	7440-41-7	1	NA	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	-	-	-	-
Cadmium, Total	7440-43-9	4	NA	ND		0.2	0.05	ND		0.2	0.05	0.6801		0.2	0.05	ND		0.2	0.05	ND		0.2	0.05	ND		0.2	0.05	ND		0.2	0.05	-	-	-	-
Chromium, Total	7440-47-3	70	NA	1.265		1	0.253	1.026		1	0.253	5.293		1	0.253	1.324		1	0.253	1.41		1	0.253	1.09		1	0.253	0.464	J	1	0.253	-	-	-	-
Copper, Total	7440-50-8	1300	NA	5.923		1	0.262	0.5243	J	1	0.262	20.25		1	0.262	8.55		1	0.262	0.5374	J	1	0.262	2.477		1	0.262	ND		1	0.262	-	-	-	-
Lead, Total	7439-92-1	5	NA	1.083		1	0.129	ND		1	0.129	12.54		1	0.129	1.071		1	0.129	0.1509	J	1	0.129	0.5	J	1	0.129	ND		1	0.129	-	-	-	-
Mercury, Total	7439-97-6	2	NA	ND		0.2	0.066	ND		0.2	0.066	0.0752	J	0.2	0.066	ND		0.2	0.066	ND		0.2	0.066	ND		0.2	0.066	ND		0.2	0.066	-	-	-	-
Nickel, Total	7440-02-0	100	NA	7.66		2	0.0865	2.424		2	0.0865	12.65		2	0.0865	1.863	J	2	0.0865	1.526	J	2	0.0865	4.351		2	0.0865	1.091	J	2	0.0865	-	-	-	-
Selenium, Total	7782-49-2	40	NA	ND		5	1	ND		5	1	2.04	J	5	1	10.4		5	1	2.51	J	5	1	ND		5	1	ND		5	1	-	-	-	-
Silver, Total	7440-22-4	40	NA	ND		0.4	0.0779	ND		0.4	0.0779	0.1919	J	0.4	0.0779	ND		0.4	0.0779	ND		0.4	0.0779	ND		0.4	0.0779	ND		0.4	0.0779	-	-	-	-
Thallium, Total	7440-28-0	2	NA	ND		0.5	0.0566	ND		0.5	0.0566	ND		0.5	0.0566	ND		0.5	0.0566	ND		0.5	0.0566	ND		0.5	0.0566	ND		0.5	0.0566	-	-	-	-
Zinc, Total	7440-66-6	2000	NA	21.98		10	2.56	ND		10	2.56	92.69		10	2.56	ND		10	2.56	ND		10	2.56	ND		10	2.56	ND		10	2.56	-	-	-	-
GENERAL CHEMISTRY																																			
Cyanide, Total	57-12-5	100	NA	ND		5	1.28	1.97	J	5	1.28	5.37		5	1.28	3.12	J	5	1.28	ND		5	1.28	ND		5	1.28	ND		5	1.28	-	-	-	-
pH (H)	12408-02-5	NA	NA	5.2		0	NA	6.6		0	NA	6.7		0	NA	7.4		0	NA	6.7		0	NA	6.8		0	NA	5.3		0	NA	-	-	-	-
Nitrogen, Ammonia	7664-41-7	3000	NA	27.4	J	75	21	1610		75	21	593		75	21	57.9	J	75	21	418		75	21	67.6	J	75	21	25.4	J	75	21	-	-	-	-
Phenolics, Total	NONE	NA	NA	ND		30	12	ND		30	12	ND		30	12	ND		30	12	13	J	30	12	ND		30	12	ND		30	12	-	-	-	-

*NJ-GWIIA: New Jersey Groundwater Quality Class IIA Criteria Current as of July 2008 regulation amendments.
*NJ-INTGW: New Jersey Interim Groundwater Quality Criteria Criteria per Ground Water Quality Standards effective November 25, 2015.

Table 3f
Hess Corporation - Port Reading Complex (HC-PR)
Quarterly Sampling Groundwater Analytical Results - No. 1 Landfarm

ANALYTE	CAS	NJ-GWIIA (ug/l)	NJ-INTGW (ug/l)	Conc	Q	RL	MDL	Conc	Q	RL	MDL	Conc	Q	RL	MDL	Conc	Q	RL	MDL	Conc	Q	RL	MDL	Conc	Q	RL	MDL	Conc	Q	RL	MDL	Conc	Q	RL	MDL
			SAMPLE ID:	L1-1				L1-2				L1-3				L1-4				BG-2				BG-3				FB				TB			
			LAB ID:	L1612337-01				L1612337-02				L1612337-03				L1612337-04				L1612337-05				L1612337-06				L1612337-07				L1612337-08			
			COLLECTION DATE:	4/26/2016				4/26/2016				4/26/2016				4/26/2016				4/26/2016				4/26/2016				4/26/2016				4/22/2016			
			SAMPLE DEPTH:																																
			SAMPLE MATRIX:	WATER				WATER				WATER				WATER				WATER				WATER				WATER				WATER			
VOLATILE ORGANICS BY GC/MS																																			
1,2-Dibromo-3-chloropropane	96-12-8	0.02	NA	ND		2.5	0.32	ND		2.5	0.32	ND		2.5	0.32	ND		2.5	0.32	ND		2.5	0.32	ND		2.5	0.32	ND		2.5	0.32	ND		2.5	0.32
1,4-Dioxane	123-91-1	NA	0.4	ND		250	41	ND		250	41	ND		250	41	ND		250	41	ND		250	41	ND		250	41	ND		250	41	ND		250	41
1,2-Dibromoethane	106-93-4	0.03	NA	ND		2	0.1	ND		2	0.1	ND		2	0.1	ND		2	0.1	ND		2	0.1	ND		2	0.1	ND		2	0.1	ND		2	0.1
Methylene chloride	75-09-2	3	NA	ND		2.5	0.27	ND		2.5	0.27	ND		2.5	0.27	ND		2.5	0.27	ND		2.5	0.27	ND		2.5	0.27	ND		2.5	0.27	ND		2.5	0.27
1,1-Dichloroethane	75-34-3	50	NA	ND		0.75	0.21	ND		0.75	0.21	ND		0.75	0.21	ND		0.75	0.21	ND		0.75	0.21	ND		0.75	0.21	ND		0.75	0.21	ND		0.75	0.21
Chloroform	67-66-3	70	NA	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16
Carbon tetrachloride	56-23-5	1	NA	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1
1,2-Dichloropropane	78-87-5	1	NA	ND		1	0.11	ND		1	0.11	ND		1	0.11	ND		1	0.11	ND		1	0.11	ND		1	0.11	ND		1	0.11	ND		1	0.11
Dibromochloromethane	124-48-1	1	NA	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15
1,1,2-Trichloroethane	79-00-5	3	NA	ND		0.75	0.09	ND		0.75	0.09	ND		0.75	0.09	ND		0.75	0.09	ND		0.75	0.09	ND		0.75	0.09	ND		0.75	0.09	ND		0.75	0.09
Tetrachloroethene	127-18-4	1	NA	0.21	J	0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09
Chlorobenzene	108-90-7	50	NA	ND		0.5	0.07	31		0.5	0.07	0.57		0.5	0.07	0.1	J	0.5	0.07	ND		0.5	0.07	ND		0.5	0.07	ND		0.5	0.07	ND		0.5	0.07
Trichlorofluoromethane	75-69-4	2000	NA	ND		2.5	0.1	ND		2.5	0.1	ND		2.5	0.1	ND		2.5	0.1	ND		2.5	0.1	ND		2.5	0.1	ND		2.5	0.1	ND		2.5	0.1
1,2-Dichloroethane	107-06-2	2	NA	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11
1,1,1-Trichloroethane	71-55-6	30	NA	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1
Bromodichloromethane	75-27-4	1	NA	ND		0.5	0.19	ND		0.5	0.19	ND		0.5	0.19	ND		0.5	0.19	ND		0.5	0.19	ND		0.5	0.19	ND		0.5	0.19	ND		0.5	0.19
trans-1,3-Dichloropropene	10061-02-6	1	NA	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15
cis-1,3-Dichloropropene	10061-01-5	1	NA	ND		0.5	0.14	ND		0.5	0.14	ND		0.5	0.14	ND		0.5	0.14	ND		0.5	0.14	ND		0.5	0.14	ND		0.5	0.14	ND		0.5	0.14
1,3-Dichloropropene, Total	542-75-6	NA	NA	ND		0.5	0.14	ND		0.5	0.14	ND		0.5	0.14	ND		0.5	0.14	ND		0.5	0.14	ND		0.5	0.14	ND		0.5	0.14	ND		0.5	0.14
Bromoform	75-25-2	4	NA	ND		2	0.25	ND		2	0.25	ND		2	0.25	ND		2	0.25	ND		2	0.25	ND		2	0.25	ND		2	0.25	ND		2	0.25
1,1,2,2-Tetrachloroethane	79-34-5	1	NA	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09
Benzene	71-43-2	1	NA	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09
Toluene	108-88-3	600	NA	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16
Ethylbenzene	100-41-4	700	NA	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1	ND		0.5	0.1
Chloromethane	74-87-3	NA	NA	ND		2.5	0.09	ND		2.5	0.09	ND		2.5	0.09	ND		2.5	0.09	ND		2.5	0.09	ND		2.5	0.09	ND		2.5	0.09	ND		2.5	0.09
Bromomethane	74-83-9	10	NA	ND		1	0.26	ND		1	0.26	ND		1	0.26	ND		1	0.26	ND		1	0.26	ND		1	0.26	ND		1	0.26	ND		1	0.26
Vinyl chloride	75-01-4	1	NA	ND		1	0.07	ND		1	0.07	ND		1	0.07	ND		1	0.07	ND		1	0.07	ND		1	0.07	ND		1	0.07	ND		1	0.07
Chloroethane	75-00-3	5	5	ND		1	0.13	ND		1	0.13	ND		1	0.13	ND		1	0.13	ND		1	0.13	ND		1	0.13	ND		1	0.13	ND		1	0.13
1,1-Dichloroethene	75-35-4	1	NA	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09	ND		0.5	0.09
trans-1,2-Dichloroethene	156-60-5	100	NA	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16	ND		0.75	0.16
Trichloroethene	79-01-6	1	NA	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11
1,2-Dichlorobenzene	95-50-1	600	NA	ND		2.5	0.07	0.65	J	2.5	0.07	ND		2.5	0.07	ND		2.5	0.07	ND		2.5	0.07	ND		2.5	0.07	ND		2.5	0.07	ND		2.5	0.07
1,3-Dichlorobenzene	541-73-1	600	NA	ND		2.5	0.07	0.77	J	2.5	0.07	ND		2.5	0.07	ND		2.5	0.07	ND		2.5	0.07	ND		2.5	0.07	ND		2.5	0.07	ND		2.5	0.07
1,4-Dichlorobenzene	106-46-7	75	NA	ND		2.5	0.08	2	J	2.5	0.08	ND		2.5	0.08	ND		2.5	0.08	ND		2.5	0.08	ND		2.5	0.08	ND		2.5	0.08	ND		2.5	0.08
Methyl tert butyl ether	1634-04-4	70	NA	ND		1	0.15	ND		1	0.15	ND		1	0.15	ND		1	0.15	ND		1	0.15	ND		1	0.15	ND		1	0.15	ND		1	0.15
p/m-Xylene	179601-23-1	NA	NA	ND		1	0.18	ND		1	0.18	ND		1	0.18	ND		1	0.18	ND		1	0.18	ND		1	0.18	ND		1	0.18	ND		1	0.18
o-Xylene	95-47-6	NA	NA	ND		1	0.17	ND		1	0.17	ND		1	0.17	ND		1	0.17	ND		1	0.17	ND		1	0.17	ND		1	0.17	ND		1	0.17
Xylene (Total)	1330-20-7	1000	NA	ND		1	0.17	ND		1	0.17	ND		1	0.17	ND		1	0.17	ND		1	0.17	ND		1	0.17	ND		1	0.17	ND		1	0.17
cis-1,2-Dichloroethene	156-59-2	70	NA	ND		0.5	0.11	0.38	J	0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11
1,2-Dichloroethene (total)	540-59-0	NA	NA	ND		0.5	0.11	0.38	J	0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11
Styrene	100-42-5	100	NA	ND		1	0.12	ND		1	0.12	ND		1	0.12	ND		1	0.12	ND		1	0.12	ND		1	0.12	ND		1	0.12	ND		1	0.12
Dichlorodifluoromethane	75-71-8	1000	NA	ND		5	0.19	ND		5	0.19	ND		5	0.19	ND		5	0.19	ND		5	0.19	ND		5	0.19	ND		5	0.19	ND		5	0.19
Acetone	67-64-1	6000	NA	ND		5	1.5	ND		5	1.5	ND		5	1.5	ND		5	1.5	ND		5	1.5	2.4	J	5	1.5	ND		5	1.5	ND		5	1.5
Carbon disulfide	75-15-0	700	NA	ND		5	0.09	ND		5	0.09	ND		5	0.09	ND		5	0.09	ND		5	0.09	ND		5	0.09	ND		5	0.09	ND		5	0.09
2-Butanone	78-93-3	300	NA	ND		5	1.9	ND		5	1.9	ND		5	1.9	ND		5	1.9	ND		5	1.9	ND		5	1.9	ND		5	1.9	ND		5	1.9
4-Methyl-2-pentanone	108-10-1	NA	NA	ND		5	0.26	ND		5	0.26	ND		5	0.26	ND		5	0.26	ND		5	0.26	ND		5	0.26	ND		5	0.26	ND		5	0.26
2-Hexanone	591-78-6	300	300	ND		5	0.14	ND		5	0.14	ND		5	0.14	ND		5	0.14	ND		5	0.14	ND		5	0.14	ND		5	0.14	ND		5	0.14
Bromochloromethane	74-97-5	NA	NA	ND		2.5	0.13	ND		2.5	0.13	ND		2.5	0.13	ND		2.5	0.13	ND		2.5	0.13	ND		2.5	0.13	ND		2.5	0.13	ND		2.5	0.13
Isopropylbenzene	98-82-8	700	NA	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11	ND		0.5	0.11
1,2,3-Trichlorobenzene	87-61-6	NA	NA	ND		2.5	0.12	ND		2.5	0.12	ND		2.5	0.12	ND		2.5	0.12	ND		2.5	0.12	ND		2.5	0.12	ND		2.5	0.12	ND		2.5	0.12
1,2,4-Trichlorobenzene	120-82-1	9	NA	ND		2.5	0.12	ND		2.5	0.12	ND		2.5	0.12	ND		2.5	0.12	ND		2.5	0.12	ND		2.5	0.12	ND		2.5	0.12	ND		2.5	0.12
Methyl Acetate	79-20-9	7000	NA	ND		2	0.23	ND		2	0.23	ND		2	0.23	ND		2	0.23	ND		2	0.23	ND		2	0.23	ND		2	0.23	ND		2	0.23
Cyclohexane	110-82-7	NA	NA	ND		10	0.27	ND		10	0.27	ND		10	0.27	ND		10	0.27	ND		10	0.27	ND		10	0.27	ND		10	0.27	ND		10	0.27
Methyl cyclohexane	108-87-2	NA	NA	ND		10	0.4	ND		10	0.4	ND		10	0.4	ND		10	0.4	ND		10	0.4	ND		10	0.4	ND		10	0.4	ND		10	0.4
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	NA	20000	ND		2.5	0.15	ND		2.5	0.15	ND		2.5	0.15	ND		2.5	0.15	ND		2.5	0.15	ND		2.5	0.15	ND		2.5	0.15	ND		2.5	0.15
Total VOCs				0.21	-	-	-	35.18	-	-	-	0.57	-	-	-	0.1	-	-	-	-	-	-	-	2.4	-	-	-	-	-	-	-	-	-	-	-
VOLATILE ORGANICS BY GC/MS-TIC																																			
Unknown Benzene		NA	NA	-		-	-	6	J	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
No Tentatively Identified Compounds		NA	NA	ND		0	0	-		-	-	ND		0	0	ND		0	0	ND		0	0	ND		0	0	ND		0	0	ND		0	0
Unknown Benzene		NA	NA	-		-	-	1.2	J	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unknown		NA	NA	-		-	-	2.1	J	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total TIC Compounds		NA	NA	-		-	-	9.3	J	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SEMIVOLATILE ORGANICS BY GC/MS																																			
Acenaphthene	83-32-9	400	NA	ND		2	0.59	ND		2	0.59	ND		2	0.59	ND		2	0.59	ND		2	0.59	ND		2	0.59	ND		2	0.59	-	-	-	-
3-Methylphenol/4-Methylphenol	108-39-4	NA	NA	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	-	-	-	-
Bis(2-chloroethyl)ether	111-44-4	7	NA	ND		2	0.67	ND		2	0.67	ND		2	0.67	ND		2	0.67	ND		2	0.67	ND		2	0.67	ND		2	0.67	-	-	-	-
2-Chloronaphthalene	91-58-7	600	NA	ND		2	0.64	ND		2	0.64	ND		2	0.64	ND		2	0.64	ND		2	0.64	ND		2	0.64	ND		2	0.64	-	-	-	-
2,4-Dinitrotoluene	121-14-2	10	NA	ND		5	0.84	ND		5	0.84	ND		5	0.84	ND		5	0.84	ND		5	0.84	ND		5	0.84	ND		5	0.84	-	-	-	-
2,6-Dinitrotoluene	606-20-2	10	NA	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	-	-	-	-
Fluoranthene	206-44-0	300	NA	ND		2	0.57	ND		2	0.57	ND		2	0.57	ND		2	0.57	ND		2	0.57	ND		2	0.57	ND		2	0.57	-	-	-	-
4-Chlorophenyl phenyl ether	7005-72-3	NA	NA	ND		2	0.62	ND		2	0.62	ND		2	0.62	ND		2	0.62	ND		2	0.62	ND		2	0.62	ND		2	0.62	-	-	-	-
Bis(2-chloroisopropyl)ether	108-60-1	300	NA	ND		2	0.7	ND		2	0.7	ND		2	0.7	ND		2	0.7	ND		2	0.7	ND		2	0.7	ND		2	0.7	-	-	-	-
Bis(2-chloroethoxy)methane	111-91-1	NA	NA	ND		5	0.63	ND		5	0.63	ND		5	0.63	ND		5	0.63	ND		5	0.63	ND		5	0.63	ND		5	0.63	-	-	-	-
Hexachlorocyclopentadiene	77-47-4	40	NA	ND		20	7.8	ND		20	7.8	ND		20	7.8	ND		20	7.8	ND		20	7.8	ND		20	7.8	ND		20	7.8	-	-	-	-
Hexachloroethane	67-72-1	7	NA	ND		2	0.68	ND		2	0.68	ND		2	0.68	ND		2	0.68	ND		2	0.68	ND		2	0.68	ND		2	0.68	-	-	-	-
Isophorone	78-59-1	40	NA	ND		5	0.6	ND		5	0.6	ND		5	0.6	ND		5	0.6	ND		5	0.6	ND		5	0.6	ND		5	0.6	-	-	-	-
Naphthalene	91-20-3	300	NA	ND		2	0.68	ND		2	0.68	ND		2	0.68	ND		2	0.68	ND		2	0.68	ND		2	0.68	ND		2	0.68	-	-	-	-
Nitrobenzene	98-95-3	6	NA	ND		2	0.75	ND		2	0.75	ND		2	0.75	ND		2	0.75	ND		2	0.75	ND		2	0.75	ND		2	0.75	-	-	-	-
NDPA/DPA	86-30-6	10	NA	ND		2	0.64	ND		2	0.64	ND		2	0.64	ND		2	0.64	ND		2	0.64	ND		2	0.64	ND		2	0.64	-	-	-	-
n-Nitrosodi-n-propylamine	621-64-7	NA	NA	ND		5	0.7	ND		5	0.7	ND		5	0.7	ND		5	0.7	ND		5	0.7	ND		5	0.7	ND		5	0.7	-	-	-	-
Bis(2-ethylhexyl)phthalate	117-81-7	3	NA	ND		3	0.91	ND		3	0.91	ND		3	0.91	ND		3	0.91	ND		3	0.91	ND		3	0.91	ND		3	0.91	-	-	-	-
Butyl benzyl phthalate	85-68-7	100	NA	ND		5	1.3	ND		5	1.3	ND		5	1.3	ND		5	1.3	ND		5	1.3	ND		5	1.3	ND		5	1.3	-	-	-	-
Di-n-butylphthalate	84-74-2	700	NA	ND		5	0.69	ND		5	0.69	ND		5	0.69	ND		5	0.69	ND		5	0.69	ND		5	0.69	ND		5	0.69	-	-	-	-
Di-n-octylphthalate	117-84-0	100	NA	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	-	-	-	-
Diethyl phthalate	84-66-2	6000	NA	ND		5	0.63	ND		5	0.63	ND		5	0.63	ND		5	0.63	ND		5	0.63	ND		5	0.63	ND		5	0.63	-	-	-	-
Dimethyl phthalate	131-11-3	100	100	ND		5	0.65	ND		5	0.65	ND		5	0.65	ND		5	0.65	ND		5	0.65	ND		5	0.65	ND		5	0.65	-	-	-	-
Chrysene	218-01-9	5	NA	ND		2	0.54	ND		2	0.54	ND		2	0.54	ND		2	0.54	ND		2	0.54	ND		2	0.54	ND		2	0.54	-	-	-	-
Acenaphthylene	208-96-8	NA	100	ND		2	0.66	ND		2	0.66	ND		2	0.66	ND		2	0.66	ND		2	0.66	ND		2	0.66	ND		2	0.66	-	-	-	-
Anthracene	120-12-7	2000	NA	ND		2	0.64	ND		2	0.64	ND		2	0.64	ND		2	0.64	ND		2	0.64	ND		2	0.64	ND		2	0.64	-	-	-	-
Benzo(ghi)perylene	191-24-2	100	100	ND		2	0.61	ND		2	0.61	ND		2	0.61	ND		2	0.61	ND		2	0.61	ND		2	0.61	ND		2	0.61	-	-	-	-
Fluorene	86-73-7	300	NA	ND		2	0.62	ND		2	0.62	ND		2	0.62	ND		2	0.62	ND		2	0.62	ND		2	0.62	ND		2	0.62	-	-	-	-
Phenanthrene	85-01-8	100	NA	ND		2	0.61	ND		2	0.61	ND		2	0.61	ND		2	0.61	ND		2	0.61	ND		2	0.61	ND		2	0.61	-	-	-	-
Pyrene	129-00-0	200	NA	ND		2	0.57	ND		2	0.57	ND		2	0.57	ND		2	0.57	ND		2	0.57	ND		2	0.57	ND		2	0.57	-	-	-	-
4-Chloroaniline	106-47-8	30	NA	ND		5	0.63	ND		5	0.63	ND		5	0.63	ND		5	0.63	ND		5	0.63	ND		5	0.63	ND		5	0.63	-	-	-	-
2-Nitroaniline	88-74-4	NA	NA	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	-	-	-	-
3-Nitroaniline	99-09-2	NA	NA	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	-	-	-	-
4-Nitroaniline	100-01-6	NA	NA	ND		5	1.3	ND		5	1.3	ND		5	1.3	ND		5	1.3	ND		5	1.3	ND		5	1.3	ND		5	1.3	-	-	-	-
Dibenzofuran	132-64-9	NA	NA	ND		2	0.66	ND		2	0.66	ND		2	0.66	ND		2	0.66	ND		2	0.66	ND		2	0.66	ND		2	0.66	-	-	-	-
2-Methylnaphthalene	91-57-6	30	30	ND		2	0.72	ND		2	0.72	ND		2	0.72	ND		2	0.72	ND		2	0.72	ND		2	0.72	ND		2	0.72	-	-	-	-
2,4,6-Trichlorophenol	88-06-2	20	NA	ND		5	0.68	ND		5	0.68	ND		5	0.68	ND		5	0.68	ND		5	0.68	ND		5	0.68	ND		5	0.68	-	-	-	-
p-Chloro-m-cresol	59-50-7	100	100	ND		2	0.62	ND		2	0.62	ND		2	0.62	ND		2	0.62	ND		2	0.62	ND		2	0.62	ND		2	0.62	-	-	-	-
2-Chlorophenol	95-57-8	40	NA	ND		2	0.63	ND		2	0.63	ND		2	0.63	ND		2	0.63	ND		2	0.63	ND		2	0.63	ND		2	0.63	-	-	-	-
2,4-Dichlorophenol	120-83-2	20	NA	ND		5	0.77	ND		5	0.77	ND		5	0.77	ND		5	0.77	ND		5	0.77	ND		5	0.77	ND		5	0.77	-	-	-	-
2,4-Dimethylphenol	105-67-9	100	NA	ND		5	1.6	ND		5	1.6	ND		5	1.6	ND		5	1.6	ND		5	1.6	ND		5	1.6	ND		5	1.6	-	-	-	-
2-Nitrophenol	88-75-5	NA	NA	ND		10	1.5	ND		10	1.5	ND		10	1.5	ND		10	1.5	ND		10	1.5	ND		10	1.5	ND		10	1.5	-	-	-	-
4-Nitrophenol	100-02-7	NA	NA	ND		10	1.8	ND		10	1.8	ND		10	1.8	ND		10	1.8	ND		10	1.8	ND		10	1.8	ND		10	1.8	-	-	-	-
2,4-Dinitrophenol	51-28-5	40	NA	ND		20	5.5	ND		20	5.5	ND		20	5.5	ND		20	5.5	ND		20	5.5	ND		20	5.5	ND		20	5.5	-	-	-	-
Phenol	108-95-2	2000	NA	ND		5	1.9	ND		5	1.9	ND		5	1.9	ND		5	1.9	ND		5	1.9	ND		5	1.9	ND		5	1.9	-	-	-	-
2-Methylphenol	95-48-7	NA	50	ND		5	1	ND		5	1	ND		5	1	ND		5	1	ND		5	1	ND		5	1	ND		5	1	-	-	-	-
2,4,5-Trichlorophenol	95-95-4	700	NA	ND		5	0.72	ND		5	0.72	ND		5	0.72	ND		5	0.72	ND		5	0.72	ND		5	0.72	ND		5	0.72	-	-	-	-
Carbazole	86-74-8	NA	NA	ND		2	0.63	ND		2	0.63	ND		2	0.63	ND		2	0.63	ND		2	0.63	ND		2	0.63	ND		2	0.63	-	-	-	-
4-Bromophenyl phenyl ether	101-55-3	NA	NA	ND		2	0.73	ND		2	0.73	ND		2	0.73	ND		2	0.73	ND		2	0.73	ND		2	0.73	ND		2	0.73	-	-	-	-
3,3'-Dichlorobenzidine	91-94-1	30	NA	ND		5	1.4	ND		5	1.4	ND		5	1.4	ND		5	1.4	ND		5	1.4	ND		5	1.4	ND		5	1.4	-	-	-	-
Benzaldehyde	100-52-7	NA	NA	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	ND		5	1.1	-	-	-	-
Acetophenone	98-86-2	700	NA	ND		5	0.85	ND		5	0.85	ND		5	0.85	ND		5	0.85	ND		5	0.85	ND		5	0.85	ND		5	0.85	-	-	-	-
Caprolactam	105-60-2	NA	5000	ND		10	3.6	ND		10	3.6	ND		10	3.6	ND		10	3.6	ND		10	3.6	ND		10	3.6	ND		10	3.6	-	-	-	-
Biphenyl	92-52-4	400	NA	ND		2	0.76	ND		2	0.76	ND		2	0.76	ND		2	0.76	ND		2	0.76	ND		2	0.76	ND		2	0.76	-	-	-	-
1,2,4,5-Tetrachlorobenzene	95-94-3	NA	NA	ND		10	0.67	ND		10	0.67	ND		10	0.67	ND		10	0.67	ND		10	0.67	ND		10	0.67	ND		10	0.67	-	-	-	-
Atrazine	1912-24-9	3	NA	ND		3	1.8	ND		3	1.8	ND		3	1.8	ND		3	1.8	ND		3	1.8	ND		3	1.8	ND		3	1.8	-	-	-	-
2,3,4,6-Tetrachlorophenol	58-90-2	200	NA	ND		5	0.93	ND		5	0.93	ND		5	0.93	ND		5	0.93	ND		5	0.93	ND		5	0.93	ND		5	0.93	-	-	-	-
Total SVOCs				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SEMIVOLATILE ORGANICS BY GC/MS-SIM																																			
4,6-Dinitro-o-cresol	534-52-1	NA	1	ND		1	1	ND		1	1	ND		1	1	ND		1	1	ND		1	1	ND		1	1	ND		1	1	-	-	-	-
Benzo(a)anthracene	56-55-3	0.1	NA	ND		0.1	0.08	ND		0.1	0.08	ND		0.1	0.08	ND		0.1	0.08	ND		0.1	0.08	ND		0.1	0.08	ND		0.1	0.08	-	-	-	-
Benzo(a)pyrene	50-32-8	0.1	NA	ND		0.1	0.03	ND		0.1	0.03	ND		0.1	0.03	ND		0.1	0.03	ND		0.1	0.03	ND		0.1	0.03	ND		0.1	0.03	-	-	-	-
Benzo(b)fluoranthene	205-99-2	0.2	NA	ND		0.2	0.06	ND		0.2	0.06	ND		0.2	0.06	ND		0.2	0.06	ND		0.2	0.06	ND		0.2	0.06	ND		0.2	0.06	-	-	-	-
Benzo(k)fluoranthene	207-08-9	0.5	NA	ND		0.2	0.06	ND		0.2	0.06	ND		0.2	0.06	ND		0.2	0.06	ND		0.2	0.06	ND		0.2	0.06	ND		0.2	0.06	-	-	-	-
Dibenzo(a,h)anthracene	53-70-3	0.3	NA	ND		0.2	0.04	ND		0.2	0.04	ND		0.2	0.04	ND		0.2	0.04	ND		0.2	0.04	ND		0.2	0.04	ND		0.2	0.04	-	-	-	-
Indeno(1,2,3-cd)pyrene	193-39-5	0.2	NA	ND		0.2	0.14	ND		0.2	0.14	ND		0.2	0.14	ND		0.2	0.14	ND		0.2	0.14	ND		0.2	0.14	ND		0.2	0.14	-	-	-	-
Hexachlorobenzene	118-74-1	0.02	NA	ND		0.02	0.01	ND		0.02	0.01	ND		0.02	0.01	ND		0.02	0.01	ND		0.02	0.01	ND		0.02	0.01	ND		0.02	0.01	-	-	-	-
Pentachlorophenol	87-86-5	0.3	NA	ND		0.3	0.06	ND		0.3	0.06	ND		0.3	0.06	ND		0.3	0.06	ND		0.3	0.06	ND		0.3	0.06	ND		0.3	0.06	-	-	-	-
Hexachlorobutadiene	87-68-3	1	NA	ND		1	0.02	ND		1	0.02	ND		1	0.02	ND		1	0.02	ND		1	0.02	ND		1	0.02	ND		1	0.02	-	-	-	-
Total SVOCs				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SEMIVOLATILE ORGANICS BY GC/MS-TIC																																			
Unknown		NA	NA	-		-	-	-		-	-	-		-	-	5.8	J	0	0	4.1	J	0	0	-		-	-	5	J	0	0	-	-	-	-
Unknown Benzene		NA	NA	-		-	-	11	J	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
No Tentatively Identified Compounds		NA	NA	ND		0	0	-		-	-	ND		0	0	-	-	-	-	-	-	-	-	ND		0	0	-	-	-	-	-	-	-	-
Unknown Benzene		NA	NA	-		-	-	4	J	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total TIC Compounds		NA	NA	-		-	-	15	J	0	0	-		-	-	5.8	J	0	0	4.1	J	0	0	-		-	-	5	J	0	0	-	-	-	-
TOTAL METALS																																			
Antimony, Total	7440-36-0	6	NA	0.3031	J	2	0.0699	0.2141	J	2	0.0699	0.2721	J	2	0.0699	2.192		2	0.0699	0.1229	J	2	0.0699	0.3595	J	2	0.0699	0.2018	J	2	0.0699	-	-	-	-
Arsenic, Total	7440-38-2	3	NA	1.12		0.5	0.123	30.53		0.5	0.123	24.57		0.5	0.123	1.482		0.5	0.123	6.946		0.5	0.123	4.888		0.5	0.123	ND		0.5	0.123	-	-	-	-
Beryllium, Total	7440-41-7	1	NA	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	ND		0.5	0.15	-	-	-	-
Cadmium, Total	7440-43-9	4	NA	0.1007	J	0.2	0.05	ND		0.2	0.05	ND		0.2	0.05	ND		0.2	0.05	ND		0.2	0.05	ND		0.2	0.05	ND		0.2	0.05	-	-	-	-
Chromium, Total	7440-47-3	70	NA	2.959		2	0.253	0.7179	J	2	0.253	0.9511	J	2	0.253	0.9128	J	2	0.253	1.009	J	2	0.253	1.087	J	2	0.253	0.5844	J	2	0.253	-	-	-	-
Copper, Total	7440-50-8	1300	NA	7.944		1	0.262	ND		1	0.262	1.23		1	0.262	4.424		1	0.262	0.2876	J	1	0.262	2.285		1	0.262	ND		1	0.262	-	-	-	-
Lead, Total	7439-92-1	5	NA	4.229		1	0.129	ND		1	0.129	0.7964	J	1	0.129	0.8002	J	1	0.129	0.1775	J	1	0.129	0.9507	J	1	0.129	ND		1	0.129	-	-	-	-
Mercury, Total	7439-97-6	2	NA	ND		0.2	0.066	ND		0.2	0.066	ND		0.2	0.066	ND		0.2	0.066	ND		0.2	0.066	ND		0.2	0.066	ND		0.2	0.066	-	-	-	-
Nickel, Total	7440-02-0	100	NA	9.838		2	0.0865	1.611	J	2	0.0865	1.592	J	2	0.0865	1.452	J	2	0.0865	1.334	J	2	0.0865	4.525		2	0.0865	0.7447	J	2	0.0865	-	-	-	-
Selenium, Total	7782-49-2	40	NA	ND		5	1	ND		5	1	ND		5	1	2.28	J	5	1	1.76	J	5	1	ND		5	1	ND		5	1	-	-	-	-
Silver, Total	7440-22-4	40	NA	0.0992	J	0.4	0.0779	ND		0.4	0.0779	ND		0.4	0.0779	ND		0.4	0.0779	ND		0.4	0.0779	ND		0.4	0.0779	ND		0.4	0.0779	-	-	-	-
Thallium, Total	7440-28-0	2	NA	ND		0.5	0.0566	ND		0.5	0.0566	ND		0.5	0.0566	ND		0.5	0.0566	ND		0.5	0.0566	ND		0.5	0.0566	ND		0.5	0.0566	-	-	-	-
Zinc, Total	7440-66-6	2000	NA	41.35		10	2.56	12.73		10	2.56	16.57		10	2.56	10.57		10	2.56	9.389	J	10	2.56	14.72		10	2.56	ND		10	2.56	-	-	-	-
GENERAL CHEMISTRY																																			
Cyanide, Total	57-12-5	100	NA	ND		5	1.4	ND		5	1.4	2.98	J	5	1.4	1.82	J	5	1.4	ND		5	1.4	ND		5	1.4	ND		5	1.4	-	-	-	-
pH (H)	12408-02-5	NA	NA	5.1		0	NA	6.5		0	NA	6.7		0	NA	7.1		0	NA	6.1		0	NA	6.7		0	NA	6.3		0	NA	-	-	-	-
Nitrogen, Ammonia	7664-41-7	3000	NA	ND		75	28.5	1280		75	28.5	1320		75	28.5	43.2	J	75	28.5	118		75	28.5	ND		75	28.5	ND		75	28.5	-	-	-	-
Phenolics, Total	NONE	NA	NA	29	J	30	12	36		30	12	ND		30	12	ND		30	12	ND		30	12	ND		30	12	13	J	30	12	-	-	-	-

*NJ-GWIIA: New Jersey Groundwater Quality Class IIA Criteria Current as of July 2008 regulation amendments.
*NJ-INTGW: New Jersey Interim Groundwater Quality Criteria Criteria per Ground Water Quality Standards effective November 25, 2015.

Table 4a - Leachate Data
No. 1 Landfarm
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Sample ID	Date	Benzene	Chlorobenzene	Ethylbenzene	Toluene	Xylene (total)	Methyl Tert Butyl Ether	Tert Butyl Alcohol	Anthracene	Benzenethiol	bis(2-Ethylhexyl)phthalate	Dimethyl phthalate	Di-n-butyl phthalate	Phenanthrene	Pyrene	Pyridine	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Mercury	Nickel	Selenium	Vanadium
NJDEP GWQS		1	50	700	600	1,000	70	100	2,000	NA	3	100	NA	NA	200	NA	6	3	6,000	1	4	70	100	5	2	100	40	**60**
NJDEP GWQS		ND	ND	ND	ND	ND	20.1	10	ND	0.68	0.73	2	ND	6.8	0.44	0.41	1.2	**10.5**	11.7	ND	ND	4.2	16.8	ND	4.2	**528**	**866**	20.4
L1 Leachate	5/4/2005	ND	NR	ND	ND	ND	NS	NS	NR	ND	ND	NR	NR	ND	ND	ND	ND	<5.0	5.6	<200	<5.0	<4.0	<10	<50	<3.0	<0.20	**246**	8.8
	7/22/2005	ND	NR	ND	ND	ND	NS	NS	NR	ND	ND	NR	NR	ND	ND	ND	ND	<5.0	6.4	<200	<5.0	<4.0	<10	<50	<3.0	<0.20	**265**	6.5
	10/28/2005	ND	NR	ND	ND	ND	NS	NS	NR	ND	ND	NR	NR	ND	ND	ND	ND	<5.0	<5.0	<200	<5.0	<4.0	<10	<50	<3.0	<0.20	**107**	6.9
	4/28/2006	ND	NR	ND	ND	ND	16.9	ND	NR	ND	ND	NR	NR	ND	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	5/11/2006	NS	NR	NS	NS	NS	NS	NS	NR	NS	NS	NR	NR	NS	NS	NS	ND	<6.0	<8.0	<200	<1.0	<4.0	<10	<50	<3.0	<0.20	**163**	<10
	7/21/2006	ND	NR	ND	ND	ND	20	ND	NR	ND	ND	NR	NR	ND	ND	ND	ND	<6.0	<8.0	<200	<1.0	<4.0	<10	<50	<3.0	<0.20	**179**	<10
	10/23/2006	ND	NR	ND	ND	ND	14.6	10	NR	ND	ND	NR	NR	ND	ND	ND	ND	<6.0	<8.0	<200	<1.0	<4.0	<10	<50	<3.0	<0.20	**174**	10.6
	4/20/2007	ND	NR	ND	ND	ND	15	ND	NR	ND	ND	NR	NR	1.7	ND	ND	ND	<6.0	9.3	<200	<1.0	<4.0	<10	<50	4.2	<0.20	**200**	<10
	7/27/2007	ND	NR	ND	ND	ND	13.4	ND	NR	ND	ND	NR	NR	ND	ND	ND	ND	<6.0	<8.0	<200	<1.0	<4.0	<10	<50	<3.0	<0.20	**137**	<10
	10/30/2007	ND	NR	ND	ND	ND	11.3	ND	NR	ND	ND	NR	NR	ND	ND	ND	ND	<6.0	<8.0	<200	<1.0	<4.0	<10	<50	<3.0	<0.20	**103**	<10
	4/17/2008	ND	NR	ND	ND	ND	11.2	ND	NR	ND	0.73	NR	NR	ND	ND	ND	ND	<6.0	7	<200	<1.0	<4.0	11.4	<50	<3.0	<0.20	**163**	<10
	7/22/2008	ND	NR	ND	ND	ND	19.8	ND	NR	ND	ND	NR	NR	ND	0.42	ND	ND	<6.0	11.1	<200	<1.0	<4.0	16.8	<50	<3.0	<0.20	**170**	20.4
	10/29/2008	ND	NR	ND	ND	ND	10	ND	NR	ND	ND	NR	NR	ND	ND	ND	ND	<6.0	10.4	<200	<1.0	4.2	15.5	<50	<3.0	<0.20	**168**	<10
	4/29/2009	ND	NR	ND	ND	ND	ND	ND	NR	ND	ND	NR	NR	ND	ND	ND	ND	<6.0	<3.0	<200	<1.0	<3.0	<10	<50	<3.0	<0.20	**195**	<10
	7/29/2009	ND	NR	ND	ND	ND	7.5	ND	NR	ND	ND	NR	NR	6.8	ND	ND	ND	<6.0	6.8	<200	<1.0	<3.0	<10	<50	<3.0	<0.20	**116**	<10
	10/27/2009	ND	ND	ND	ND	ND	20.1	9.9	ND	ND	ND	NR	NR	ND	0.44	ND	ND	<6.0	<8.0	<200	<1.0	<3.0	11.3	<50	<3.0	<0.20	**126**	<10
	4/7/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NR	NR	ND	ND	ND	ND	<6.0	<8.0	<200	<1.0	<3.0	<10	<50	<3.0	<0.20	**122**	<10
	7/22/2010	ND	ND	ND	ND	ND	ND	ND	ND	0.68	ND	NR	NR	ND	ND	0.41	1.2	<6.0	7	<200	<1.0	<3.0	10.1	<50	<3.0	<0.20	**106**	<10
	10/25/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NR	NR	ND	ND	ND	ND	<6.0	11.7	<200	<1.0	<3.0	10.5	<50	<3.0	<0.20	**93.5**	10.8
	4/20/2011	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NR	NR	ND	ND	ND	ND	<6.0	4.3	<200	<1.0	<3.0	<10	<50	<3.0	<0.20	**866**	<10
	7/21/2011	ND	ND	ND	ND	ND	NR	NR	ND	NR	ND	NR	NR	5.1	ND	ND	ND	<6.0	5.9	<200	<1.0	<3.0	<10	<50	<3.0	<0.20	**351**	<10
	10/21/2011	ND	ND	ND	ND	ND	NR	NR	ND	ND	ND	NR	NR	ND	ND	ND	ND	<6.0	8.7	<200	<1.0	<3.0	<10	<50	<3.0	<0.20	**358**	<10
	4/25/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.3 J	NR	NR	0.49 J	ND	ND	<6.0	**10.2**	<200	<1.0	<3.0	<10	<50	<15	<0.20	**451**	<10	<50
	7/27/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NR	NR	ND	ND	ND	<6.0	<3.0	<200	<1.0	<3.0	<10	<50	<3.0	<0.20	**137**	<10	<50
	10/23/2012	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	NR	NR	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
	4/23/2013	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	NR	NR	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
	7/24/2013	ND	ND	ND	ND	ND	2.4	ND	ND	ND	ND	2.0	NR	ND	ND	ND	<6.0	**8.0**	<200	<1.0	<3.0	<10	<50	<9.0[a]	<0.20	**115**	<10	<50
	10/9/2013	ND	ND	ND	ND	ND	3.7 J	ND	ND	ND	ND	ND	NR	ND	ND	ND	<30[a]	**10.5**	<200	<1.0	<3.0	<10	<50	<3.0	<0.20	82.6	<50[a]	<50
	4/23/2014	ND	ND	ND	ND	ND	2.4	ND	ND	ND	ND	ND	NR	ND	ND	ND	<6.0	**4.3**	<200	<1.0	<3.0	<10	<50	<15	<0.20	**422**	<10	<50
	7/23/2014	ND	ND	ND	ND	ND	2.0	ND	ND	ND	ND	ND	1.2 J	ND	ND	ND	<6.0	<9.0[a]	<200	<1.0	<3.0	<10	<50	<3.0	<0.20	**308**	<10	<50
	10/29/2014	ND	ND	ND	ND	ND	0.98 J	ND	ND	ND	ND	ND	8.7 b	ND	ND	ND	<6.0	**3.1**	<200	<1.0	<3.0	<10	<50	<3.0	<0.20	**528**	<10	<50
	4/24/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<6.0	<3.0	<200	<1.0	<3.0	<10	<50	<3.0	<0.20	**356**	<10	<50

All data reported in ug/l unless otherwise noted
GWQS- Groundwater Quality Standard
Values in **bold** indicate value above GWQC
a- Elevated Detection Limit due to dilution required from high interfering element

ND- Not Detect
NR- Not Reported
- Indicates Run Limit exceeds applicable standard
b- Analyte found in associated method blank

Table 4b
Hess Corporation - Former Port Reading Complex - 750 Cliff Road, Port Reading, New Jersey
No. 1 Landfarm - Leachate Analytical Results

Client Sample ID:		NJ Groundwater Criteria (NJAC 7:9C 7/07)[1]	NJ Interim Groundwater Criteria (NJAC 7:9C 11/15)[2]	L1-LEACHATE	L1-LEACHATE
Lab Sample ID:				JC632-1	JC7295-1
Date Sampled:				7/31/2015	10/27/2015
Matrix:				Water	Water
GC/MS Volatiles (SW846 8260C)					
Benzene	ug/l	1	-	ND (0.24)	ND (0.24)
2-Butanone (MEK)	ug/l	300	-	ND (5.6)	ND (5.6)
Carbon disulfide	ug/l	700	-	ND (0.25)	ND (0.25)
Chlorobenzene	ug/l	50	-	ND (0.19)	ND (0.19)
Chloroform	ug/l	70	-	ND (0.19)	ND (0.19)
1,2-Dibromoethane	ug/l	0.03	-	ND (0.23)	ND (0.23)
1,2-Dichloroethane	ug/l	2	-	ND (0.18)	ND (0.18)
1,4-Dioxane	ug/l	-	0.4	ND (41)	ND (41)
Ethylbenzene	ug/l	700	-	ND (0.27)	ND (0.27)
Methyl Tert Butyl Ether	ug/l	70	-	1.3	0.86 J
Styrene	ug/l	100	-	ND (0.27)	ND (0.27)
Tert Butyl Alcohol	ug/l	100	-	ND (2.8)	ND (2.8)
Toluene	ug/l	600	-	ND (0.16)	ND (0.16)
Vinyl chloride	ug/l	1	-	ND (0.15)	ND (0.15)
Xylene (total)	ug/l	1000	-	ND (0.17)	ND (0.17)
GC/MS Semi-volatiles (SW846 8270D)					
Benzenethiol	ug/l	-	-	ND (5.5)	ND (5.5)
2,4-Dimethylphenol	ug/l	100	-	ND (1.9)	ND (1.8)
2,4-Dinitrophenol	ug/l	40	-	ND (6.6)	ND (6.5)
2-Methylphenol	ug/l	-	50	ND (1.3)	ND (1.3)
3&4-Methylphenol	ug/l	-	50	ND (1.1)	ND (1.1)
4-Nitrophenol	ug/l	-	-	ND (0.92)	ND (0.91)
Phenol	ug/l	2000	-	ND (0.55)	ND (0.55)
Anthracene	ug/l	2000	-	ND (0.19)	ND (0.19)
Benzo(a)anthracene	ug/l	0.1	-	ND (0.22)	ND (0.22)
Benzo(a)pyrene	ug/l	0.1	-	ND (0.24)	ND (0.24)
Benzo(b)fluoranthene	ug/l	0.2	-	ND (0.23)	ND (0.22)
Benzo(k)fluoranthene	ug/l	0.5	-	ND (0.22)	ND (0.22)
Butyl benzyl phthalate	ug/l	100	-	ND (0.22)	ND (0.22)
Chrysene	ug/l	5	-	ND (0.16)	ND (0.16)
1,2-Dichlorobenzene	ug/l	600	-	ND (0.31)	ND (0.31)
1,3-Dichlorobenzene	ug/l	600	-	ND (0.29)	ND (0.29)
1,4-Dichlorobenzene	ug/l	75	-	ND (0.30)	ND (0.30)
7,12-Dimethylbenz(a)anthracene	ug/l	-	-	ND (0.24)	ND (0.23)
Dibenz(a,h)acridine	ug/l	-	-	ND (0.22)	ND (0.22)
Dibenzo(a,h)anthracene	ug/l	0.3	-	ND (0.28)	ND (0.28)
Di-n-butyl phthalate	ug/l	700	-	ND (0.59)	ND (0.58)
Di-n-octyl phthalate	ug/l	100	-	ND (0.25)	ND (0.25)
Diethyl phthalate	ug/l	6000	-	ND (0.24)	ND (0.23)
Dimethyl phthalate	ug/l	-	100	ND (0.26)	ND (0.26)
bis(2-Ethylhexyl)phthalate	ug/l	3	-	ND (0.56)	ND (0.55)
Fluoranthene	ug/l	300	-	ND (0.16)	ND (0.16)
Indene	ug/l	-	-	ND (0.31)	ND (0.30)
1-Methylnaphthalene	ug/l	-	5	ND (0.31)	ND (0.31)
6-Methyl Chrysene	ug/l	-	-	ND (0.76)	ND (0.75)
Naphthalene	ug/l	300	-	ND (0.27)	ND (0.27)
Phenanthrene	ug/l	-	-	ND (0.19)	ND (0.19)
Pyrene	ug/l	200	-	ND (0.19)	ND (0.19)
Pyridine	ug/l	-	-	ND (0.29)	ND (0.29)
Quinoline	ug/l	-	-	ND (0.35)	ND (0.35)
Metals Analysis					
Antimony	ug/l	6	-	<6.0	<6.0
Arsenic	ug/l	3	-	**8.9** [a]	<9.0 [a]
Barium	ug/l	6000	-	<200	<200
Beryllium	ug/l	1	-	<1.0	<1.0
Cadmium	ug/l	4	-	<3.0	<3.0
Chromium	ug/l	70	-	<10	<10
Cobalt	ug/l	-	100	<50	<50
Lead	ug/l	5	-	<6.0 [a]	<9.0 [a]
Mercury	ug/l	2	-	<0.20	<0.20
Nickel	ug/l	100	-	**308**	**622**
Selenium	ug/l	40	-	<10	<10
Vanadium	ug/l	-	-	<50	<50

Table 4c
Hess Corporation - Former Port Reading Complex - 750 Cliff Road, Port Reading, New Jersey
No. 1 Landfarm - Leachate Analytical Results

Client Sample ID:		NJ Groundwater	NJ Interim	L1-LEACHATE
Lab Sample ID:		Criteria	Groundwater	JC21748-1
Date Sampled:			Criteria	6/8/2016
Matrix:				Water
GC/MS Volatiles (SW846 8260C)				
Benzene	ug/l	1	-	ND (0.14)
2-Butanone (MEK)	ug/l	300	-	ND (1.9)
Carbon disulfide	ug/l	700	-	ND (0.33)
Chlorobenzene	ug/l	50	-	ND (0.17)
Chloroform	ug/l	70	-	ND (0.23)
1,2-Dibromoethane	ug/l	0.03	-	ND (0.22)
1,2-Dichloroethane	ug/l	2	-	ND (0.39)
1,4-Dioxane	ug/l	-	0.4	ND (32)
Ethylbenzene	ug/l	700	-	ND (0.20)
Methyl Tert Butyl Ether	ug/l	70	-	0.64 J
Styrene	ug/l	100	-	ND (0.27)
Tert Butyl Alcohol	ug/l	100	-	ND (3.0)
Toluene	ug/l	600	-	ND (0.23)
Vinyl chloride	ug/l	1	-	ND (0.33)
Xylene (total)	ug/l	1000	-	ND (0.21)
GC/MS Semi-volatiles (SW846 8270D)				
Benzenethiol	ug/l	-	-	ND (20)
2,4-Dimethylphenol	ug/l	100	-	ND (2.4)
2,4-Dinitrophenol	ug/l	40	-	ND (1.6)
2-Methylphenol	ug/l	-	50	ND (0.89)
3&4-Methylphenol	ug/l	-	50	ND (0.88)
4-Nitrophenol	ug/l	-	-	ND (1.2)
Phenol	ug/l	2000	-	ND (0.39)
Anthracene	ug/l	2000	-	ND (0.21)
Benzo(a)anthracene	ug/l	0.1	-	ND (0.20)
Benzo(a)pyrene	ug/l	0.1	-	ND (0.21)
Benzo(b)fluoranthene	ug/l	0.2	-	ND (0.21)
Benzo(k)fluoranthene	ug/l	0.5	-	ND (0.21)
Butyl benzyl phthalate	ug/l	100	-	ND (0.46)
Chrysene	ug/l	5	-	ND (0.18)
1,2-Dichlorobenzene	ug/l	600	-	ND (0.17)
1,3-Dichlorobenzene	ug/l	600	-	ND (0.19)
1,4-Dichlorobenzene	ug/l	75	-	ND (0.17)
7,12-Dimethylbenz(a)anthracene	ug/l	-	-	ND (0.80)
Dibenz(a,h)acridine	ug/l	-	-	ND (0.55)
Dibenzo(a,h)anthracene	ug/l	0.3	-	ND (0.33)
Di-n-butyl phthalate	ug/l	700	-	ND (0.50)
Di-n-octyl phthalate	ug/l	100	-	ND (0.23)
Diethyl phthalate	ug/l	6000	-	ND (0.26)
Dimethyl phthalate	ug/l	-	100	ND (0.22)
bis(2-Ethylhexyl)phthalate	ug/l	3	-	ND (1.7)
Fluoranthene	ug/l	300	-	ND (0.17)
Indene	ug/l	-	-	ND (0.30)
1-Methylnaphthalene	ug/l	-	5	ND (0.26)
6-Methyl Chrysene	ug/l	-	-	ND (5.0)
Naphthalene	ug/l	300	-	ND (0.23)
Phenanthrene	ug/l	-	-	ND (0.18)
Pyrene	ug/l	200	-	ND (0.22)
Pyridine	ug/l	-	-	ND (0.39)
Quinoline	ug/l	-	-	ND (0.21)
Metals Analysis				
Antimony	ug/l	6	-	<6.0
Arsenic	ug/l	3	-	**8.4**
Barium	ug/l	6000	-	<200
Beryllium	ug/l	1	-	<1.0
Cadmium	ug/l	4	-	<3.0
Chromium	ug/l	70	-	<10
Cobalt	ug/l	-	100	<50
Lead	ug/l	5	-	<9.0 [a]
Mercury	ug/l	2	-	<0.20
Nickel	ug/l	100	-	**550**
Selenium	ug/l	40	-	13.5
Vanadium	ug/l	-	-	<50
Footnotes:				
[a] Elevated detection limit due to dilution required for high interfering element.				

Table 4c
Hess Corporation - Former Port Reading Complex - 750 Cliff Road, Port Reading, New Jersey
No.1 Landfarm - Leachate Analytical Results

Client Sample ID:		NJ Groundwater Criteria	NJ Interim Groundwater Criteria	L1-LEACHATE
Lab Sample ID:				JC24491-1
Date Sampled:				7/21/2016
Matrix:				Water
GC/MS Volatiles (SW846 8260C)				
Benzene	ug/l	1	-	ND (0.14)
2-Butanone (MEK)	ug/l	300	-	ND (1.9)
Carbon disulfide	ug/l	700	-	ND (0.33)
Chlorobenzene	ug/l	50	-	ND (0.17)
Chloroform	ug/l	70	-	ND (0.23)
1,2-Dibromoethane	ug/l	0.03	-	ND (0.22)
1,2-Dichloroethane	ug/l	2	-	ND (0.39)
1,4-Dioxane	ug/l	-	0.4	ND (32)
Ethylbenzene	ug/l	700	-	ND (0.20)
Methyl Tert Butyl Ether	ug/l	70	-	0.63 J
Styrene	ug/l	100	-	ND (0.27)
Tert Butyl Alcohol	ug/l	100	-	ND (3.0)
Toluene	ug/l	600	-	ND (0.23)
Vinyl chloride	ug/l	1	-	ND (0.33)
Xylene (total)	ug/l	1000	-	ND (0.21)
GC/MS Semi-volatiles (SW846 8270D)				
Benzenethiol	ug/l	-	-	ND (20)
2,4-Dimethylphenol	ug/l	100	-	ND (2.4)
2,4-Dinitrophenol	ug/l	40	-	ND (1.6)
2-Methylphenol	ug/l	-	50	ND (0.89)
3&4-Methylphenol	ug/l	-	50	ND (0.88)
4-Nitrophenol	ug/l	-	-	ND (1.2)
Phenol	ug/l	2000	-	ND (0.39)
Anthracene	ug/l	2000	-	ND (0.21)
Benzo(a)anthracene	ug/l	0.1	-	ND (0.20)
Benzo(a)pyrene	ug/l	0.1	-	ND (0.21)
Benzo(b)fluoranthene	ug/l	0.2	-	ND (0.21)
Benzo(k)fluoranthene	ug/l	0.5	-	ND (0.21)
Butyl benzyl phthalate	ug/l	100	-	ND (0.46)
Chrysene	ug/l	5	-	ND (0.18)
1,2-Dichlorobenzene	ug/l	600	-	ND (0.17)
1,3-Dichlorobenzene	ug/l	600	-	ND (0.19)
1,4-Dichlorobenzene	ug/l	75	-	ND (0.17)
7,12-Dimethylbenz(a)anthracene	ug/l	-	-	ND (0.80)
Dibenz(a,h)acridine	ug/l	-	-	ND (0.55) [a]
Dibenzo(a,h)anthracene	ug/l	0.3	-	ND (0.33)
Di-n-butyl phthalate	ug/l	700	-	ND (0.50)
Di-n-octyl phthalate	ug/l	100	-	ND (0.23)
Diethyl phthalate	ug/l	6000	-	ND (0.26)
Dimethyl phthalate	ug/l	-	100	ND (0.22)
bis(2-Ethylhexyl)phthalate	ug/l	3	-	ND (1.7)
Fluoranthene	ug/l	300	-	ND (0.17)
Indene	ug/l	-	-	ND (0.30)
1-Methylnaphthalene	ug/l	-	5	ND (0.26)
6-Methyl Chrysene	ug/l	-	-	ND (5.0)
Naphthalene	ug/l	300	-	ND (0.23)
Phenanthrene	ug/l	-	-	ND (0.18)
Pyrene	ug/l	200	-	ND (0.22)
Pyridine	ug/l	-	-	ND (0.39) [b]
Quinoline	ug/l	-	-	ND (0.21) [b]
Metals Analysis				
Antimony	ug/l	6	-	<6.0
Arsenic	ug/l	3	-	<9.0
Barium	ug/l	6000	-	<200
Beryllium	ug/l	1	-	<1.0
Cadmium	ug/l	4	-	<3.0
Chromium	ug/l	70	-	<10
Cobalt	ug/l	-	100	<50
Lead	ug/l	5	-	<9.0
Mercury	ug/l	2	-	<0.30 [c]
Nickel	ug/l	100	-	**489**
Selenium	ug/l	40	-	<10
Vanadium	ug/l	-	-	<50

Footnotes:

[a] The spike standard was not added in LCS.

[b] This compound outside control limits biased low in the associated BS. The result confirmed by reextraction outside the holding time.

[c] Elevated sample detection limit due to difficult sample matrix.

*NJ-GWIIA: New Jersey Groundwater Quality Class IIA Criteria Current as of July 2008 regulation amendments.

*NJ-INTGW: New Jersey Interim Groundwater Quality Criteria Criteria per Ground Water Quality Standards effective November 25, 2015.

Table 5a Lysimeter Data
No. 1 Landfarm
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Analysis		Volatiles								Semi-Volatile Organic Compounds				General Chemistry			Metals											
Sample ID	Date	Benzene	Carbon disulfide	Chlorobenzene	Ethylbenzene	Methyl Tert Butyl Ether	Tert Butyl Alcohol	Toluene	Xylene (total)	Phenol	bis(2-Ethylhexyl)phthalate	Dimethyl phthalate	3&4-Methylphenol	Ammonia	*pH (su)	Sulfide Reactivity (mg/l)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Mercury	Nickel	Selenium	Vanadium
NJDEP GWQS		1	700	50	700	70	100	600	1,000	2,000	3	100	NA	3000	6.5 - 8.5	NA	6	3	6,000	1	4	70	NA	5	2	100	40	60
Minimum Conc.		ND	0.49	0.76	ND	0.5	ND	ND	ND	2.2	1.4	2.5	16.7	ND	**3.96**	60	ND	7.1	374	ND	ND	27.2	ND	3.5	0.23	14.2	ND	ND
Maximum Conc.		ND	0.76	0.76	ND	0.71	ND	ND	ND	2.2	**837**	2.5	16.7	ND	6.94	60	ND	**56.5**	374	ND	ND	113	ND	**379**	0.48	**237**	ND	ND
LY1	5/4/2005	ND	ND	ND	ND	NA	NA	ND	ND	NA	NA	NR	NA	NA	**5.88**	60	<5.0	<5.0	<200	<5.0	<4.0	<10	<50	<3.0	<0.20	67.2	<5.0	NA
	7/22/2005	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	NR	ND	NA	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY
	10/28/2005	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	NR	ND	NA	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY
	1/20/2006	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NR	ND	NA	**5.9**	<50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/28/2006	ND	ND	ND	ND	0.5	ND	ND	ND	NA	NA	NR	NA	NA	6.36	NA	<6.0	<8.0	<200	<1.0	<4.0	<10	<50	<3.0	<0.20	69.1	NA	NA
	7/21/2006	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.8	NR	ND	NA	**4.7**	NA	<6.0	<8.0	<200	<1.0	<4.0	<10	<50	<3.0	<0.20	101	<10	<50
	10/23/2006	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NR	ND	NA	**5.17**	NA	<6.0	<8.0	<200	<1.0	<4.0	<10	<50	<3.0	<0.20	106	NA	<50
	1/26/2007	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NR	NA	NA	6.86	NA	<6.0	<8.0	<200	<1.0	<4.0	<10	<50	<3.0	<0.20	<40	NA	NA
	4/20/2007	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.6	NR	ND	NA	**6.11**	NA	<6.0	<8.0	<200	<1.0	<4.0	<10	<50	<3.0	<0.20	55.7	NA	NA
	7/27/2007	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NR	NA	NA	**5.48**	<100	<6.0	<8.0	<200	<1.0	<4.0	<10	<50	<3.0	<0.20	61.2	<10	<50
	10/30/2007	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NR	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/11/2008	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NR	NA	NA	6.62	NA	<6.0	<8.0	<200	<1.0	<4.0	<10	<50	<3.0	<0.20	<40	<10	<50
	4/17/2008	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.5	NR	ND	NA	6.94	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	7/22/2008	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	NR	NA	NA	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY
	10/29/2008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NR	ND	NA	**5.74**	NA	<6.0	<3.0	<200	<1.0	<3.0	<10	<50	<3.0	<0.20	**128**	NA	NA
	1/22/2009	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NR	NA	NA	NA	<100	<6.0	<3.0	<200	<1.0	<3.0	<10	<50	<3.0	<0.20	54.6	NA	NA
	4/29/2009	ND	0.76	ND	ND	ND	ND	ND	ND	NA	NA	NR	ND	NA	**5.96**	NA	<6.0	<3.0	<200	<1.0	<3.0	<10	<50	<3.0	<0.20	89.5	NA	NA
	7/29/2009	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NR	NA	NA	6.58	<100	<6.0	<3.0	<200	<1.0	<3.0	<10	<50	<3.0	<0.20	**107**	<10	<50
	7/22/2010	ND	ND	0.76	ND	ND	ND	ND	ND	ND	ND	NR	ND	NA	6.5	<100	<6.0	<3.0	<200	<1.0	<3.0	<10	<50	4.8	<0.20	<10	<10	<50
	7/20/2011	ND	ND	ND	ND	NR	NR	ND	ND	ND	1.4J	NR	ND	NA	NA	<100	<30	**56.5**	<1,000	<5.0	<15	**113**	<250	**331**	1.9[a]	**204**	<50	<250
	7/25/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NR	NA	NA	**5.84**	<100	<30[a]	**49[a]**	NA	<5.0[a]	<15[a]	**113[a]**	NA	**379[a]**	1.4[a]	**237[a]**	<50[a]	NA
	12/14/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NR	ND	<200	NA	<100	<30[a]	<15[a]	374	<1.0	<15[a]	<50[a]	<250	<15[a]	<0.20	90.7[a]	<50[a]	<250
	7/26/2013	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.5	ND	<0.20	NA	<100	<6.0	<3.0	<200	<1.0	<3.0	<10	<50	**7.8**	<0.20	44.7	<10	<50
	7/23/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<0.20	**5.90**	<100	<6.0	<3.0	<200	<1.0	<3.0	<10	<50	<3.0	<0.20	14.2	<10	<50

Table 5a Lysimeter Data
No. 1 Landfarm
Hess Port Reading Refinery
750 Cliff Road
Port Reading, Middlesex County, New Jersey

Analysis		Volatiles								Semi-Volatile Organic Compounds			
Sample ID	Date	Benzene	Carbon disulfide	Chlorobenzene	Ethylbenzene	Methyl Tert Butyl Ether	Tert Butyl Alcohol	Toluene	Xylene (total)	Phenol	bis(2-Ethylhexyl)phthalate	Dimethyl phthalate	3&4-Methylphenol
NJDEP GWQS		1	700	50	700	70	100	600	1,000	2,000	3	100	NA
Minimum Conc.		ND	0.49	0.76	ND	0.5	ND	ND	ND	2.2	1.4	2.5	16.7
Maximum Conc.		ND	0.76	0.76	ND	0.71	ND	ND	ND	2.2	**837**	2.5	16.7
LY2	5/4/2005	ND	ND	ND	ND	NA	NA	ND	ND	NA	NA	NR	NA
	7/22/2005	ND	ND	ND	ND	NA	NA	ND	ND	2.2	**7.7**	NR	ND
	10/28/2005	ND	ND	ND	ND	NA	NA	ND	ND	ND	1.4	NR	ND
	1/20/2006	ND	ND	ND	ND	ND	ND	ND	ND	ND	**12**	NR	ND
	4/28/2006	ND	ND	ND	ND	0.71	ND	ND	ND	NA	NA	NR	NA
	7/21/2006	ND	ND	ND	ND	ND	ND	ND	ND	ND	**837**	NR	ND
	10/23/2006	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NR	ND
	1/26/2007	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NR	NA
	4/20/2007	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.6	NR	ND
	7/27/2007	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NR	NA
	10/30/2007	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.9	NR	ND
	1/11/2008	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NR	NA
	4/17/2008	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.5	NR	ND
	7/22/2008	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NR	NA
	10/29/2008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NR	ND
	1/22/2009	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NR	NA
	4/29/2009	ND	0.49	ND	ND	ND	ND	ND	ND	ND	1.8	NR	ND
	7/29/2009	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NR	NA
	7/22/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NR	16.7
	7/20/2011	ND	ND	ND	ND	NR	NR	ND	ND	ND	**17.0**	NR	ND
	7/25/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NR	NA
	12/14/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	**3.6**	NR	ND
	10/9/2013	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/23/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Analysis		General Chemistry			Metals											
Sample ID	Date	Ammonia	*pH (su)	Sulfide Reactivity (mg/l)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Mercury	Nickel	Selenium	Vanadium
NJDEP GWQS		3000	6.5 - 8.5	NA	6	3	6,000	1	4	70	NA	5	2	100	40	60
Minimum Conc.		ND	**3.96**	60	ND	7.1	374	ND	ND	27.2	ND	3.5	0.23	14.2	ND	ND
Maximum Conc.		ND	6.94	60	ND	**56.5**	374	ND	ND	113	ND	**379**	0.48	**237**	ND	ND
LY2	5/4/2005	NA	NA	NA	<5.0	<5.0	<200	<5.0	<4.0	<10	<50	**9.6**	<0.20	<40	<5.0	NA
	7/22/2005	NA	6.55	<50	<5.0	**8.4**	<200	<5.0	<4.0	<10	<50	**11.8**	<0.20	<40	<5.0	<50
	10/28/2005	NA	**5.62**	<50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/20/2006	NA	**5.79**	<50	<5.0	<5.0	<200	<1.0	<4.0	<10	<50	**13**	<0.20	<40	NA	NA
	4/28/2006	NA	6.6	NA	<6.0	<8.0	<200	<1.0	<4.0	<10	<50	**6.4**	<0.20	<40	NA	NA
	7/21/2006	NA	**4.33**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10/23/2006	NA	6.69	<100	<6.0	<8.0	<200	<1.0	<4.0	<10	<50	**21**	<0.20	<40	NA	<50
	1/26/2007	NA	6.59	NA	<6.0	<8.0	<200	<1.0	<4.0	<10	<50	<3.0	<0.20	<40	NA	NA
	4/20/2007	NA	**6.03**	NA	<6.0	<8.0	<200	<1.0	<4.0	<10	<50	**5.3**	0.31	<40	NA	NA
	7/27/2007	NA	6.73	<100	<6.0	**13.2**	<200	<1.0	<4.0	<10	<50	**23.2**	<0.20	<40	<10	<50
	10/30/2007	NA	**6.33**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/11/2008	NA	**6.48**	<100	<6.0	**<8.0**	<200	<1.0	<4.0	<10	<50	<3.0	<0.20	<40	<10	NA
	4/17/2008	NA	6.84	NA	<6.0	<3.0	<200	<1.0	<4.0	<10	<50	**16.3**	<0.20	<40	NA	NA
	7/22/2008	NA	NA	NA	<6.0	<3.0	<200	<1.0	<4.0	<10	<50	**5**	<0.20	<40	<10	<50
	10/29/2008	NA	**6.36**	NA	<6.0	<3.0	<200	<1.0	<3.0	<10	<50	**5.9**	<0.20	<10	NA	NA
	1/22/2009	NA	NA	<100	<6.0	<3.0	<200	<1.0	<3.0	<10	<50	3.5	<0.20	<10	NA	NA
	4/29/2009	NA	6.71	<100	<6.0	<3.0	<200	<1.0	<3.0	<10	<50	4	<0.20	<10	NA	NA
	7/29/2009	NA	6.58	<100	<6.0	<3.0	<200	<1.0	<3.0	<10	<50	**6.6**	<0.20	<10	<10	<50
	7/22/2010	NA	6.61	<100	<6.0	<3.0	<200	<1.0	<3.0	<10	<50	**12.5**	<0.20	<10	<10	<50
	7/20/2011	NA	NA	<100	<6.0	**16.4**	<200	<1.0	<3.0	27.2	<50	**42.9**	0.48	22.5	<10	<50
	7/25/2012	NA	**3.96**	<100	<30[a]	**50.0[a]**	NA	<5.0[a]	<15[a]	**158[a]**	NA	**210[a]**	**2.4[a]**	81.5[a]	<50[a]	NA
	12/14/2012	<200	NA	NA	<30[a]	**18.4[a]**	<200	<1.0	<15[a]	<50[a]	<250	<15[a]	<0.20	<50[a]	<50[a]	<250
	10/9/2013	<200	**6.23**	<100	<6.0	<3.0	<200	<1.0	<3.0	<10	<50	4.0	0.23	<10	<10	<50
	7/23/2014	<0.20	**6.02**	<100	<6.0	7.1	<200	<1.0	<3.0	<10	<50	**14.5**	0.43	<10	<10	<50

All data reported in ug/l unless otherwise noted ND - Not Detected * pH sample received out of holding time
GWQS - Groundwater Quality Standard NR - Not Reported NA - Not Analyzed
Values in **bold** indicate value is above GWQS
a - Elevated sample detection limit due to difficult sample matrix/matrix interference Indicates run limit is greater than GWQS
b - Sample pH did not satisfy preservation criteria

Table 5b
Hess Corporation - Port Reading Complex (HC-PR)
Lysimeter Analytical Results - No. 1 Landfarm

Client Sample ID:		**NJ Groundwater Criteria**	**NJ Interim Groundwater Criteria**	**LY-1**
Lab Sample ID:				**JC607-1**
Date Sampled:				**7/31/2015**
Matrix:				**Ground Water**
GC/MS Volatiles (SW846 8260C)				
Benzene	ug/l	1	-	ND (0.24)
Toluene	ug/l	600	-	ND (0.16)
Ethylbenzene	ug/l	700	-	ND (0.27)
Xylene (total)	ug/l	1000	-	ND (0.17)
Methyl Tert Butyl Ether	ug/l	70	-	ND (0.24)
Tert Butyl Alcohol	ug/l	100	-	ND (2.8)
Carbon disulfide	ug/l	700	-	ND (0.25)
Chlorobenzene	ug/l	50	-	ND (0.19)
GC/MS Semi-volatiles (SW846 8270D)				
2,4-Dimethylphenol	ug/l	100	-	ND (3.0)
2-Methylphenol	ug/l	-	50	ND (2.0)
3&4-Methylphenol	ug/l	-	50	ND (1.7)
Phenol	ug/l	2000	-	ND (0.88)
Anthracene	ug/l	2000	-	ND (0.30)
Benzo(a)anthracene	ug/l	0.1	-	ND (0.35)
Benzo(a)pyrene	ug/l	0.1	-	ND (0.39)
Benzo(b)fluoranthene	ug/l	0.2	-	ND (0.36)
Butyl benzyl phthalate	ug/l	100	-	ND (0.36)
Chrysene	ug/l	5	-	ND (0.26)
bis(2-Chloroisopropyl)ether	ug/l	300	-	ND (0.65)
1,2-Dichlorobenzene	ug/l	600	-	ND (0.49)
Dibenz(a,h)acridine	ug/l	-	-	ND (0.35)
Dibenzo(a,h)anthracene	ug/l	0.3	-	ND (0.45)
Di-n-butyl phthalate	ug/l	700	-	ND (0.94)
Dimethyl phthalate	ug/l	-	100	ND (0.42)
bis(2-Ethylhexyl)phthalate	ug/l	3	-	ND (0.89)
Fluoranthene	ug/l	300	-	ND (0.26)
Indene	ug/l	-	-	ND (0.49)
1-Methylnaphthalene	ug/l	-	5	ND (0.49)
Naphthalene	ug/l	300	-	ND (0.43)
Phenanthrene	ug/l	-	-	ND (0.30)
Pyrene	ug/l	200	-	ND (0.31)
Metals Analysis				
Antimony	ug/l	6	-	<6.0
Arsenic	ug/l	3	-	<3.0
Barium	ug/l	6000	-	<200
Beryllium	ug/l	1	-	<1.0
Cadmium	ug/l	4	-	<3.0
Chromium	ug/l	70	-	<10
Cobalt	ug/l	-	100	<50
Lead	ug/l	5	-	<3.0
Mercury	ug/l	2	-	<0.20
Nickel	ug/l	100	-	41.8
Selenium	ug/l	40	-	<10
Vanadium	ug/l	-	-	<50
General Chemistry				
Nitrogen, Ammonia	mg/l	3	-	<0.20
Sulfide Reactivity	mg/l	-	-	<100
pH	su	6.5-8.5	-	**5.72** [a]
Footnotes:				
[a] Sample received out of holding time for pH analysis.				

Table 5c
Hess Corporation - Former Port Reading Complex - 750 Cliff Road, Port Reading, New Jersey
No.1 Landfarm - Lysimeter Analytical Results

			SAMPLE ID:	LY-1			
			LAB ID:	L1622745-04			
			COLLECTION DATE:	7/21/2016			
			SAMPLE DEPTH:				
			SAMPLE MATRIX:	WATER			
		NJ-GWIIA	NJ-INTGW				
ANALYTE	CAS	(ug/l)	(ug/l)	Conc	Q	RL	MDL
VOLATILE ORGANICS BY GC/MS							
1,2-Dibromo-3-chloropropane	96-12-8	0.02	NA	ND		2.5	0.32
1,4-Dioxane	123-91-1	NA	0.4	ND		250	41
1,2-Dibromoethane	106-93-4	0.03	NA	ND		2	0.1
Methylene chloride	75-09-2	3	NA	ND		2.5	0.27
1,1-Dichloroethane	75-34-3	50	NA	ND		0.75	0.21
Chloroform	67-66-3	70	NA	ND		0.75	0.16
Carbon tetrachloride	56-23-5	1	NA	ND		0.5	0.1
1,2-Dichloropropane	78-87-5	1	NA	ND		1	0.11
Dibromochloromethane	124-48-1	1	NA	ND		0.5	0.15
1,1,2-Trichloroethane	79-00-5	3	NA	ND		0.75	0.09
Tetrachloroethene	127-18-4	1	NA	ND		0.5	0.09
Chlorobenzene	108-90-7	50	NA	ND		0.5	0.07
Trichlorofluoromethane	75-69-4	2000	NA	ND		2.5	0.1
1,2-Dichloroethane	107-06-2	2	NA	ND		0.5	0.11
1,1,1-Trichloroethane	71-55-6	30	NA	ND		0.5	0.1
Bromodichloromethane	75-27-4	1	NA	ND		0.5	0.19
trans-1,3-Dichloropropene	10061-02-6	1	NA	ND		0.5	0.15
cis-1,3-Dichloropropene	10061-01-5	1	NA	ND		0.5	0.14
1,3-Dichloropropene, Total	542-75-6	NA	NA	ND		0.5	0.14
Bromoform	75-25-2	4	NA	ND		2	0.25
1,1,2,2-Tetrachloroethane	79-34-5	1	NA	ND		0.5	0.09
Benzene	71-43-2	1	NA	ND		0.5	0.09
Toluene	108-88-3	600	NA	ND		0.75	0.16
Ethylbenzene	100-41-4	700	NA	ND		0.5	0.1
Chloromethane	74-87-3	NA	NA	ND		2.5	0.09
Bromomethane	74-83-9	10	NA	ND		1	0.26
Vinyl chloride	75-01-4	1	NA	ND		0.2	0.07
Chloroethane	75-00-3	5	5	ND		1	0.13
1,1-Dichloroethene	75-35-4	1	NA	ND		0.5	0.09
trans-1,2-Dichloroethene	156-60-5	100	NA	ND		0.75	0.16
Trichloroethene	79-01-6	1	NA	ND		0.5	0.11
1,2-Dichlorobenzene	95-50-1	600	NA	ND		2.5	0.07
1,3-Dichlorobenzene	541-73-1	600	NA	ND		2.5	0.07
1,4-Dichlorobenzene	106-46-7	75	NA	ND		2.5	0.08
Methyl tert butyl ether	1634-04-4	70	NA	ND		1	0.15
p/m-Xylene	179601-23-1	NA	NA	ND		1	0.18
o-Xylene	95-47-6	NA	NA	ND		1	0.17
Xylene (Total)	1330-20-7	1000	NA	ND		1	0.17
cis-1,2-Dichloroethene	156-59-2	70	NA	ND		0.5	0.11
1,2-Dichloroethene (total)	540-59-0	NA	NA	ND		0.5	0.11
Styrene	100-42-5	100	NA	ND		1	0.12
Dichlorodifluoromethane	75-71-8	1000	NA	ND		5	0.19
Acetone	67-64-1	6000	NA	ND		5	1.5
Carbon disulfide	75-15-0	700	NA	ND		5	0.09
2-Butanone	78-93-3	300	NA	ND		5	1.9
4-Methyl-2-pentanone	108-10-1	NA	NA	ND		5	0.26
2-Hexanone	591-78-6	300	300	ND		5	0.14
Bromochloromethane	74-97-5	NA	NA	ND		2.5	0.13
Isopropylbenzene	98-82-8	700	NA	ND		0.5	0.11
1,2,3-Trichlorobenzene	87-61-6	NA	NA	ND		2.5	0.12
1,2,4-Trichlorobenzene	120-82-1	9	NA	ND		2.5	0.12
Methyl Acetate	79-20-9	7000	NA	ND		2	0.23
Cyclohexane	110-82-7	NA	NA	ND		10	0.27
Methyl cyclohexane	108-87-2	NA	NA	ND		10	0.4
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	NA	20000	0.71	J	2.5	0.15
Total VOCs				0.71	-	-	-
VOLATILE ORGANICS BY GC/MS-TIC							
Unknown		NA	NA	6.81	J	0	0
Total TIC Compounds		NA	NA	6.81	J	0	0
BASE/NEUTRAL EXTRACTABLES BY GC/MS- WESTBOROUGH LAB							
Acenaphthene	83-32-9	400	NA	ND		2	0.58
Bis(2-chloroethyl)ether	111-44-4	7	NA	ND		2	0.66
2-Chloronaphthalene	91-58-7	600	NA	ND		2	0.63
2,4-Dinitrotoluene	121-14-2	10	NA	ND		4.9	0.83
2,6-Dinitrotoluene	606-20-2	10	NA	ND		4.9	1.1
Fluoranthene	206-44-0	300	NA	ND		2	0.56
4-Chlorophenyl phenyl ether	7005-72-3	NA	NA	ND		2	0.61
Bis(2-chloroisopropyl)ether	108-60-1	300	NA	ND		2	0.68
Bis(2-chloroethoxy)methane	111-91-1	NA	NA	ND		4.9	0.62
Hexachlorocyclopentadiene	77-47-4	40	NA	ND		20	7.7
Hexachloroethane	67-72-1	7	NA	ND		2	0.67
Isophorone	78-59-1	40	NA	ND		4.9	0.59
Naphthalene	91-20-3	300	NA	ND		2	0.67
Nitrobenzene	98-95-3	6	NA	ND		2	0.74
NDPA/DPA	86-30-6	10	NA	ND		2	0.63
n-Nitrosodi-n-propylamine	621-64-7	NA	NA	ND		4.9	0.69
Bis(2-ethylhexyl)phthalate	117-81-7	3	NA	ND		3	0.9
Butyl benzyl phthalate	85-68-7	100	NA	ND		4.9	1.2
Di-n-butylphthalate	84-74-2	700	NA	ND		4.9	0.68
Di-n-octylphthalate	117-84-0	100	NA	ND		4.9	1.1
Diethyl phthalate	84-66-2	6000	NA	ND		4.9	0.62
Dimethyl phthalate	131-11-3	100	100	ND		4.9	0.64
Chrysene	218-01-9	5	NA	ND		2	0.53
Acenaphthylene	208-96-8	NA	100	ND		2	0.65
Anthracene	120-12-7	2000	NA	ND		2	0.63
Benzo(ghi)perylene	191-24-2	100	100	ND		2	0.6
Fluorene	86-73-7	300	NA	ND		2	0.61
Phenanthrene	85-01-8	100	NA	ND		2	0.6
Pyrene	129-00-0	200	NA	ND		2	0.56
4-Chloroaniline	106-47-8	30	NA	ND		4.9	0.62
2-Nitroaniline	88-74-4	NA	NA	ND		4.9	1.1
3-Nitroaniline	99-09-2	NA	NA	ND		4.9	1.1
4-Nitroaniline	100-01-6	NA	NA	ND		4.9	1.3
Dibenzofuran	132-64-9	NA	NA	ND		2	0.64
2-Methylnaphthalene	91-57-6	30	30	ND		2	0.71
Carbazole	86-74-8	NA	NA	ND		2	0.62
4-Bromophenyl phenyl ether	101-55-3	NA	NA	ND		2	0.72
3,3'-Dichlorobenzidine	91-94-1	30	NA	ND		4.9	1.4
Benzaldehyde	100-52-7	NA	NA	ND		4.9	1.1
Acetophenone	98-86-2	700	NA	ND		4.9	0.83
Caprolactam	105-60-2	NA	5000	ND		9.8	3.5
Biphenyl	92-52-4	400	NA	ND		2	0.74
1,2,4,5-Tetrachlorobenzene	95-94-3	NA	NA	ND		9.8	0.66
Atrazine	1912-24-9	3	NA	ND		3	1.8
BASE/NEUTRAL EXTRACTABLES BY GC/MS- WESTBOROUGH LAB-TIC							
Unknown Ketone		NA	NA	4.41	J	0	0
Unknown Alkane		NA	NA	4.55	J	0	0
Total TIC Compounds		NA	NA	8.96	J	0	0
BASE/NEUTRAL EXTRACTABLES BY GC/MS-SIM							
Benzo(a)anthracene	56-55-3	0.1	NA	ND		0.1	0.08
Benzo(a)pyrene	50-32-8	0.1	NA	ND		0.1	0.03
Benzo(b)fluoranthene	205-99-2	0.2	NA	ND		0.2	0.06
Benzo(k)fluoranthene	207-08-9	0.5	NA	ND		0.2	0.06
Dibenzo(a,h)anthracene	53-70-3	0.3	NA	ND		0.2	0.04
Indeno(1,2,3-cd)pyrene	193-39-5	0.2	NA	ND		0.2	0.14
Hexachlorobenzene	118-74-1	0.02	NA	ND		0.02	0.01
Hexachlorobutadiene	87-68-3	1	NA	ND		0.98	0.02
TOTAL METALS							
Aluminum, Total	7429-90-5	200	NA	126		10	1.69
Antimony, Total	7440-36-0	6	NA	0.3994	J	2	0.0699
Arsenic, Total	7440-38-2	3	NA	0.8483		0.5	0.123
Barium, Total	7440-39-3	6000	NA	4.205		1	0.0625
Beryllium, Total	7440-41-7	1	NA	ND		0.5	0.15
Cadmium, Total	7440-43-9	4	NA	0.1244	J	0.2	0.05
Calcium, Total	7440-70-2	NA	NA	3600		100	32
Chromium, Total	7440-47-3	70	NA	1.409		1	0.253
Cobalt, Total	7440-48-4	100	100	0.3711		0.2	0.0621
Copper, Total	7440-50-8	1300	NA	7.441		1	0.262
Iron, Total	7439-89-6	300	NA	179		50	12
Lead, Total	7439-92-1	5	NA	2.489		1	0.129
Magnesium, Total	7439-95-4	NA	NA	2490		70	22.3
Manganese, Total	7439-96-5	50	NA	5.314		1	0.302
Mercury, Total	7439-97-6	2	NA	ND		0.2	0.066
Nickel, Total	7440-02-0	100	NA	39.92		2	0.0865
Potassium, Total	7440-09-7	NA	NA	708		100	19.3
Selenium, Total	7782-49-2	40	NA	ND		5	1
Silver, Total	7440-22-4	40	NA	ND		0.4	0.0779
Sodium, Total	7440-23-5	50000	NA	4730		100	16.1
Thallium, Total	7440-28-0	2	NA	ND		0.5	0.0566
Vanadium, Total	7440-62-2	NA	NA	1.017	J	5	0.551
Zinc, Total	7440-66-6	2000	NA	233.4		10	2.56
GENERAL CHEMISTRY							
Nitrogen, Ammonia	7664-41-7	3000	NA	36	J	75	28.5
Nitrogen, Nitrate/Nitrite	NONE	10000	NA	3200		100	19
Total Nitrogen	NONE	NA	NA	3600		300	300
Nitrogen, Total Kjeldahl	NONE	NA	NA	449		300	66
Cyanide, Reactive	57-12-5	NA	NA	ND		1000	1000
Sulfide, Reactive	NONE	NA	NA	ND		1000	1000

*NJ-GWIIA: New Jersey Groundwater Quality Class IIA Criteria Current as of July 2008 regulation amendments.
*NJ-INTGW: New Jersey Interim Groundwater Quality Criteria Criteria per Ground Water Quality Standards effective November

Table 6 - Thiessen Polygon Average Calculations

No. 1 Landfarm Soil Core Monitoring Summary

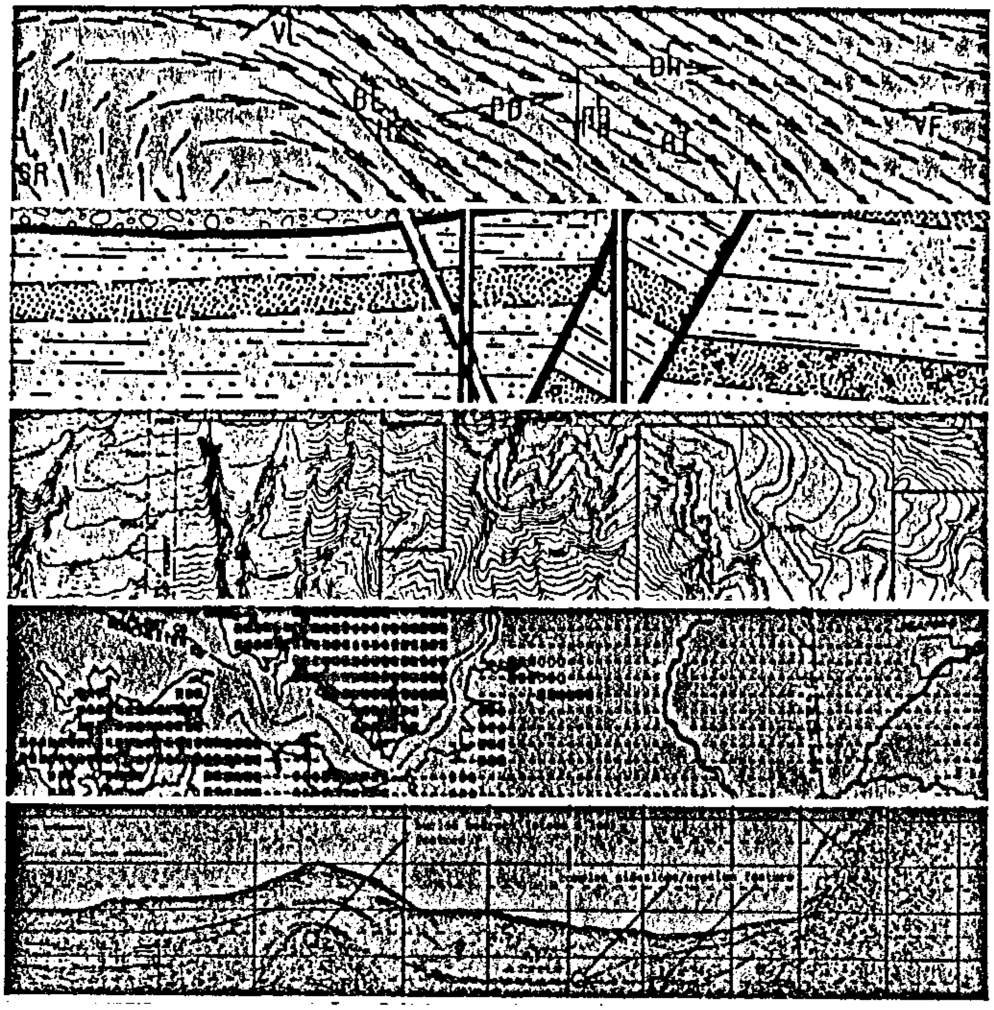
Hess Port Reading Refinery

750 Cliff Road

Port Reading, Middlesex County, New Jersey

Sample ID	**Area**		**Benzene**	
	Sq. Feet	**Acres**	**Conc (mg/kg)**	**Conc. * Area**
NJDEP Default IGW SSL (mg/kg)			**0.005**	
Thiessen Polygon Average (mg/kg)			**0.048**	
TZ	41,407	0.95	**0.0069**	285.71
UZ	21,910	0.50	0	0
UZ	13,746	0.32	0	0
ZOI	22,391	0.51	0	0
TZ	57,140	1.31	**0.156**	8913.86
ZOI	36,613	0.84	0	0
Total Area	**193,209**	**4.44**		

APPENDIX 1
March 1984 Soil/Groundwater Investigation Report



REPORT
SOILS AND GROUND WATER INVESTIGATION
PROPOSED LAND FARM
PORT READING REFINERY
PORT READING, NEW JERSEY
AMERADA HESS CORPORATION

MARCH 1984
JOB NO. 2405-170-10

Dames & Moore

Dames & Moore

6 Commerce Drive
Cranford, New Jersey 07016
(201) 272-8300
TWX: 710-996-5806 Cable address: DAMEMORE

March 12, 1984

Amerada Hess Corporation
One Hess Plaza
Woodbridge, New Jersey 07095

Attention: Dr. T. Helfgott

Subject: Report
Soils and Ground Water Investigation
Proposed Land Farm
Port Reading Refinery
Port Reading, New Jersey
Amerada Hess Corporation

Dr. Helfgott:

1.0 INTRODUCTION

This report presents the results of our ground water and soils investigation at the proposed land farm at the Amerada Hess Corporation Refinery, Port Reading, New Jersey. The requirements and scope of this investigation were developed at meetings among Dr. T. Helfgott, Amerada Hess Corporation; Mr. Michael Corn, AWARE Corporation; and Messrs. Joseph Minster and Anthony Kaufman, Dames & Moore.

2.0 PURPOSE

The purposes of our work were:

1. Classify the soil texture in accordance with the United States Department of Agriculture (USDA) Soil Classification System;

2. Characterize the soil by determining grain size and providing the following information on soil properties required by the New Jersey Department of Environmental Protection (NJDEP) which includes pH, bulk density, porosity, permeability and Cation Exchange Capacity (CEC) including the calculation of percent sodium saturation, exchangeable bases, and Sodium Adsorption Ratio (SAR).

3. Develop general geologic information and provide a cross section of the site.

4. determine depth to ground water.

In order to achieve the purposes of this investigation, it was agreed that three test borings would be drilled to depths 10 feet below the water table or to a maximum depth of 30 feet. Each boring would be converted into a temporary ground water observation well. Water levels would be observed and noted both during drilling operations and after well installation. Soil samples would be obtained in order to maintain a field log of each boring and to be brought back to Dames & Moore's laboratory for further analysis. Composite samples comprising the upper five feet of soil encountered at each boring would be taken to Stablex-Reutter, Inc., of Camden, New Jersey, for determination of pH and CEC. Following data analysis, we would to submit a report outlining our findings.

3.0 FIELD INVESTIGATION

Three borings were drilled to depths of 17 feet using a truck-mounted Mobile rotary-wash drilling rig. General boring locations were determined by Messrs. Corn and Kaufman, and were staked by Mr. Andrew Kurucz of Amerada Hess Corporation. Borings were drilled essentially as staked. Figure 1, the Location Map, and Figure 2, the Plot Plan, show the approximate boundaries of the site and the boring locations.

Relatively undisturbed continuous soil samples were obtained for the top five feet of soil using a Dames & Moore U-type sampler (Figure 3). Casing was then driven to the next sampling depths, 10 and 15 feet below ground surface. Soils were drilled and washed out of the casing and additional soil samples were obtained using a standard split-spoon sampler. Soil samples could not be obtained at intermediate depths owing to the nature of the material encountered and the drilling method needed to accomplish the work. Drill cuttings and wash were observed in order to characterize the soil at intermediate depths. Moisture content of the soil samples was noted as was the depth to ground water while drilling was in progress. Samples were visually inspected and classified according to the Unified Soil Classification System (Figure 4) and stored in labeled, sealed, plastic bags for further classification and analysis.

The borings were converted to temporary ground water observation wells by installing two-inch I.D. Schedule 40 PVC screen (slot size equals .020 inch) from 15 feet below grade to above the anticipated water level. Filter sand was poured in the annular space between the well screen and casing. The casing was removed and the sand given a bentonite pellet seal. PVC riser pipe extends from the well screen to between one and two feet above ground surface. Ground water was expected to be within six inches of ground surface at OW-3 and therefore, no riser pipe was installed. This well was screened from 15 feet below ground level to above ground surface. Protective steel casing with a locking steel cap was placed over the riser pipe. Figures 5, 5A and 5B depict the as-built well specifications for each monitoring well. Additional water levels were observed after well installation.

Wells were developed by pumping and surging with a centrifugal pump in order to remove fine-grained sediment from the screen and sand pack. Between 60 and 100 gallons of water were removed from each well at a discharge rate of three gallons per minute. Development continued until the discharged water showed only slight turbidity indicating that the sand pack was clean.

Dames & Moore

All work was performed under the supervision of Dames & Moore assistant geologist, Anthony Kaufman.

3.1 LABORATORY TESTING

Representative portions from the upper five feet of material encountered in each boring were selected for analysis in Dames & Moore's Soils Laboratory. Analysis included:

1. Bulk density
2. Specific Gravity
3. Permeability
4. Calculated Porosity
5. Grain-size

Composite samples of the remaining material were then sent to Stablex-Reutter Laboratories, Inc. for determination of pH and cation exchange capacity.

4.0 SURFACE CONDITIONS

The site is a partially open, partially weed covered field of approximately five to seven acres. The field lies north of existing tanks Nos. 1207 and 1210. The surface is comprised of moist sandy fill with some silt and gravel, and it is generally level.

5.0 DISCUSSION AND CONCLUSIONS

5.1 GEOLOGY

The refinery site lies along the line separating two major physiographic provinces: the Coastal Plain Province and the Piedmont Province. The former roughly lies southeast of a line from Plainsboro to Carteret and is underlain by unconsolidated sands and clays of Cretaceous age. The Piedmont Province includes the area to the north and west of the Coastal Plain Province and is underlain by relatively hard Triassic shale.

The Triassic rocks are believed to have been deposited as sediments in the latter part of the geologic period. The rocks were later uplifted, tilted down to the northwest, faulted and eroded. At the start of the Cretaceous age, the land surface had been reduced to a plain of moderate relief sloping to the southeast at about 60 feet per mile. Cretaceous sands and clays were deposited upon it in alternating layers dipping to the southeast and thickening oceanward.

The Tertiary period that followed left no record. In the Quaternary period, which extends to the present, the region was invaded by the Wisconsin continental glacier from the north. Glacial drift composed of unstratified material deposited during the Wisconsin glaciation now blankets the area and underlies soft organic river deposits of geologically recent age in the region of the Arthur Kill.

5.2 STRATIGRAPHY

With the exception of the upper five feet of material seen at OW-3, the stratigraphy encountered at each boring is relatively similar to that seen at the other borings. Generally, the upper 8 to 10 feet of soil is brown, loose, sandy fill. The fill overlies approximately two feet of dark peat with varying amounts of sand which grades downward into a greenish gray silty clay rich in plant fibers and other organic matter. This organic rich soil is underlain by soft gray clay. All soils encountered were either moist or saturated. These vertical stratigraphic changes are typical for what one would expect at the site of a fill covered marine tidal marsh. A log of each boring is presented in Figures 5, 5A and 5B. Based on the information contained in these logs, an interpretive geologic cross section has been prepared and is presented as a fence diagram in Figure 6.

Stratigraphic differences seen at OW-3 include the presence of a dark, very fine sand and silt lens at two-foot depth, which is underlain by about six inches of soft gray clay. The sandy fill above the sandy silt lens was highly saturated. These conditions were not observed at OW-1 or OW-2 and appear to be of only local significance.

An earlier subsurface investigation performed at this location by Dames & Moore entitled "Preliminary Site Investigation, Proposed Fuel Gas Plant", January 4, 1972, reports stratigraphy similar to that outlined in this report with the exception that in the southeast corner of the site no clay was found and the sandy fill extended to approximately 15 feet below grade. North and northeast of the proposed landfarm, fill was less than four feet thick. This previous report also cites poorly graded sand with some gravel as material which extends from a depth of about 20 feet to between 52 and 65 feet. These soils rest on decomposed rock.

5.3 SOIL CLASSIFICATION AND CHARACTERISTICS

According to the Interim Soil Survey Report, Middlesex County, New Jersey, 1978, the area investigated during this project is identified only as "cut and fill land, sandy". The U. S. Department of Agriculture (USDA Soil Conservation Service) which prepared the report, fails to classify the material any further, and states that "on-site investigations are needed at each site".

As part of this investigation, grain size analyses were performed on representative portions of the red-brown sand found near the surface in each boring. In addition, a grain-size analysis was performed on the dark, very fine sand and silt found at approximately two foot depth in OW-3. Grain size curves for the red-brown sand are presented in Figures 7, 8 and 9. From data obtained by these analyses and by visual examination, the black very fine sand encountered at OW-3 was classified according to USDA texture standards as silty clay loam. The red-brown sand which comprises the bulk of the top five feet of soil across the entire site is classified according to USDA texture standards as sand and gravelly sand. The remaining classifications as shown on the boring logs are based on visual examination of the soil samples. Figure 4A illustrates the soil texture classification diagram used by the USDA.

Additional soil parameters identified for the top five feet of soil as part of this investigation are shown on Table 1. It should be noted that some settling of the samples occurred during transportation from the field to the laboratory. As such, the values shown for bulk density may be greater, and the values shown for permeability and porosity may be lower than actual in situ values of this material.

5.4 GROUND WATER DATA

Ground water first encountered at depth beneath the site appears to be no deeper than approximately 5-1/2 feet below grade.

Observation Well (OW-) Designation	Depth of Ground Water Below Ground Surface (in feet)		Elevation of Ground Water (in feet above Mean Sea Level)	
	2/15/84*	2/22/84	2/15/84*	2/22/84
OW-1 (East Well)	1.43	1.97	10.36	9.82
OW-2 (South Well)	4.52	4.17	7.72	8.07
OW-3 (West Well)	5.19	5.19	4.47	4.47

* = Rained heavily on this date.

An inconsistency is noted for OW-3 in that while sampling the near surface sandy fill and prior to drilling, the depth to ground water ranged from 0.4 to 0.7 feet below ground surface. This indicates that the area around OW-3 may be the site of a temporarily locally perched water table. After drilling to 17 feet and installing the well, depth to ground water at this location was approximately 5-1/2 feet below ground surface. No such inconsistency was found at the other boring locations. The conclusion of a perched water table is supported by the observations that the ground surface around this well was flooded on February 15, 1984, following rains of the previous day and that a clay lense exists at about 2-1/2 feet below ground surface at this location. Similar clay lenses may exist at other localities on the site but it is beyond the scope of this report to confirm this possibility.

Dames & Moore

The surficial soils appear relatively coarse and permeable, and primary recharge to the water bearing formation is likely to be the result of downward percolation of rain water. Warm temperatures which melted any snow cover, periods of rain during the night of February 13 to 14 and the morning of February 15, and light rain on February 19 and 21, 1984 may have raised the observed water level.

The following tables and figures are included in this report:

Table 1	Summary of Soil Sample Analyses, Physical Parameters
Table 2	Summary of Soil Sample Analysis, Ionic Parameters
Figure 1	Location Map
Figure 2	Plot Plan
Figure 3	Dames & Moore Sampler
Figure 4	Unified Soil Classification System
Figure 4A	U. S. Dept. of Agriculture Texture Classification Diagram
Figure 5	Logs of Borings and Well Schematics
Figure 5A	Logs of Borings and Well Schematics
Figure 5B	Logs of Borings and Well Schematics
Figure 6	Fence Diagram — Cross Section
Figures 7, 8 and 9	Gradation Curves

Very truly yours,

DAMES & MOORE

Malcolm D. Horton

Malcolm D. Horton
Partner

Anthony Kaufman

Anthony Kaufman
Assistant Geologist

MDH/AK:jp

Attachments

ATTACHMENTS

TABLE 2

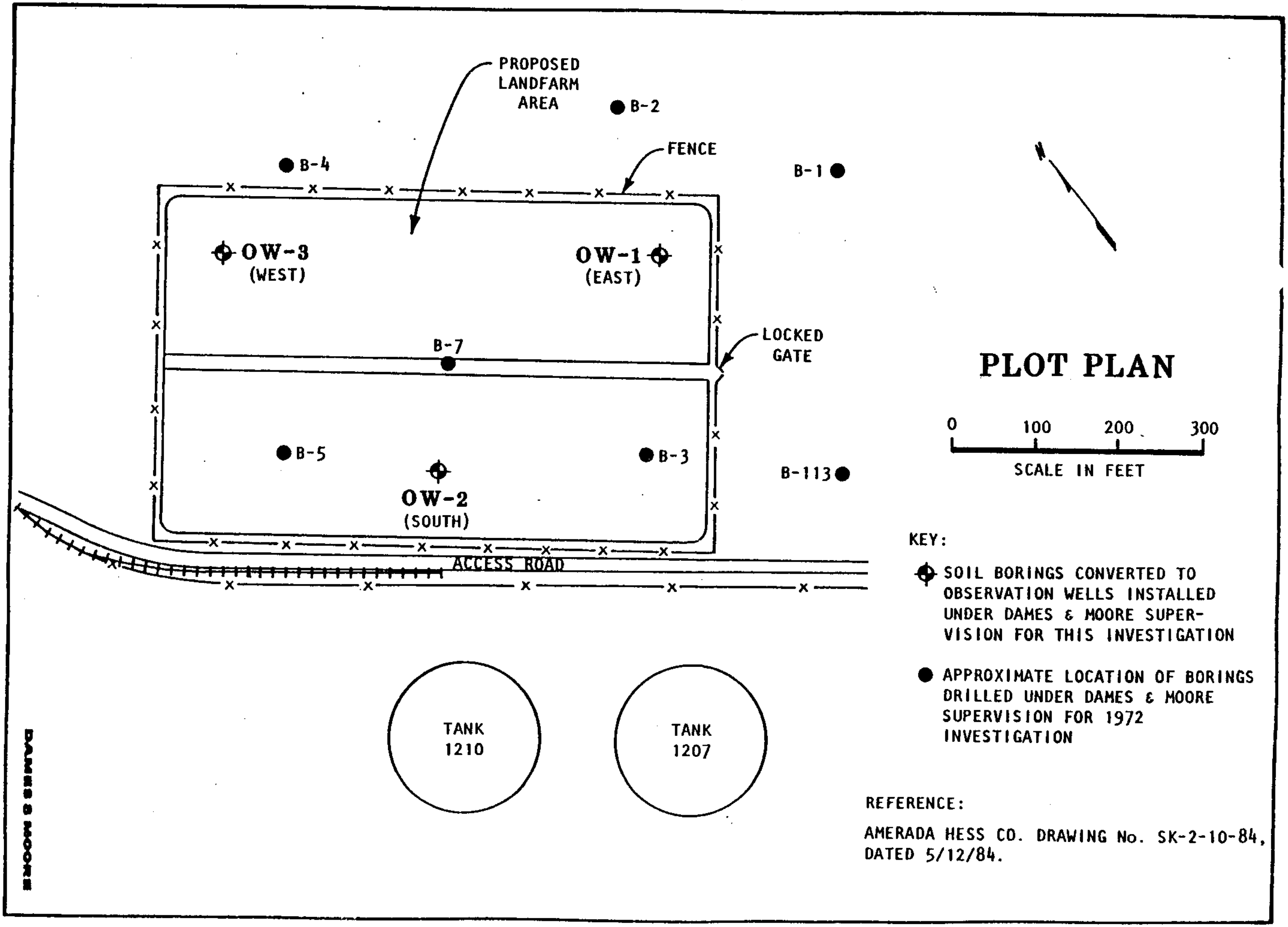
SUMMARY OF SOIL SAMPLE ANALYSES, IONIC PARAMETERS

Sample Designation	pH	Units Expressed as Milliequivalents Per 100 Grams						% Sodium Saturation	Sodium Adsorp' Ratio
		Cation Exchange Capacity	Exchangeable Bases						
			Calcium	Magnesium	Potassium	Sodium			
OW-1	7.0	110	24	7.1	1.7	110		0.016	8.6
OW-2	8.5	70	70	5.0	1.1	70		0.016	3.6
OW-3	7.5	170	41	6.3	2.5	170		0.015	11.0

NOTES:

Analysis based on composite samples of the upper five feet of soil.

Analysis performed by Stablex-Reutter, Inc., Camden, New Jersey.


PROPOSED
LANDFARM
AREA
B-2
FENCE
B-4
B-1
OW-3
(WEST)
OW-1
(EAST)
B-7
LOCKED
GATE
PLOT PLAN
0
100
200
300
SCALE IN FEET
B-5
B-3
B-113
OW-2
(SOUTH)
ACCESS ROAD
KEY:
SOIL BORINGS CONVERTED TO OBSERVATION WELLS INSTALLED UNDER DAMES & MOORE SUPERVISION FOR THIS INVESTIGATION
APPROXIMATE LOCATION OF BORINGS DRILLED UNDER DAMES & MOORE SUPERVISION FOR 1972 INVESTIGATION
TANK
1210
TANK
1207
REFERENCE:
AMERADA HESS CO. DRAWING No. SK-2-10-84, DATED 5/12/84.
DAMES & MOORE

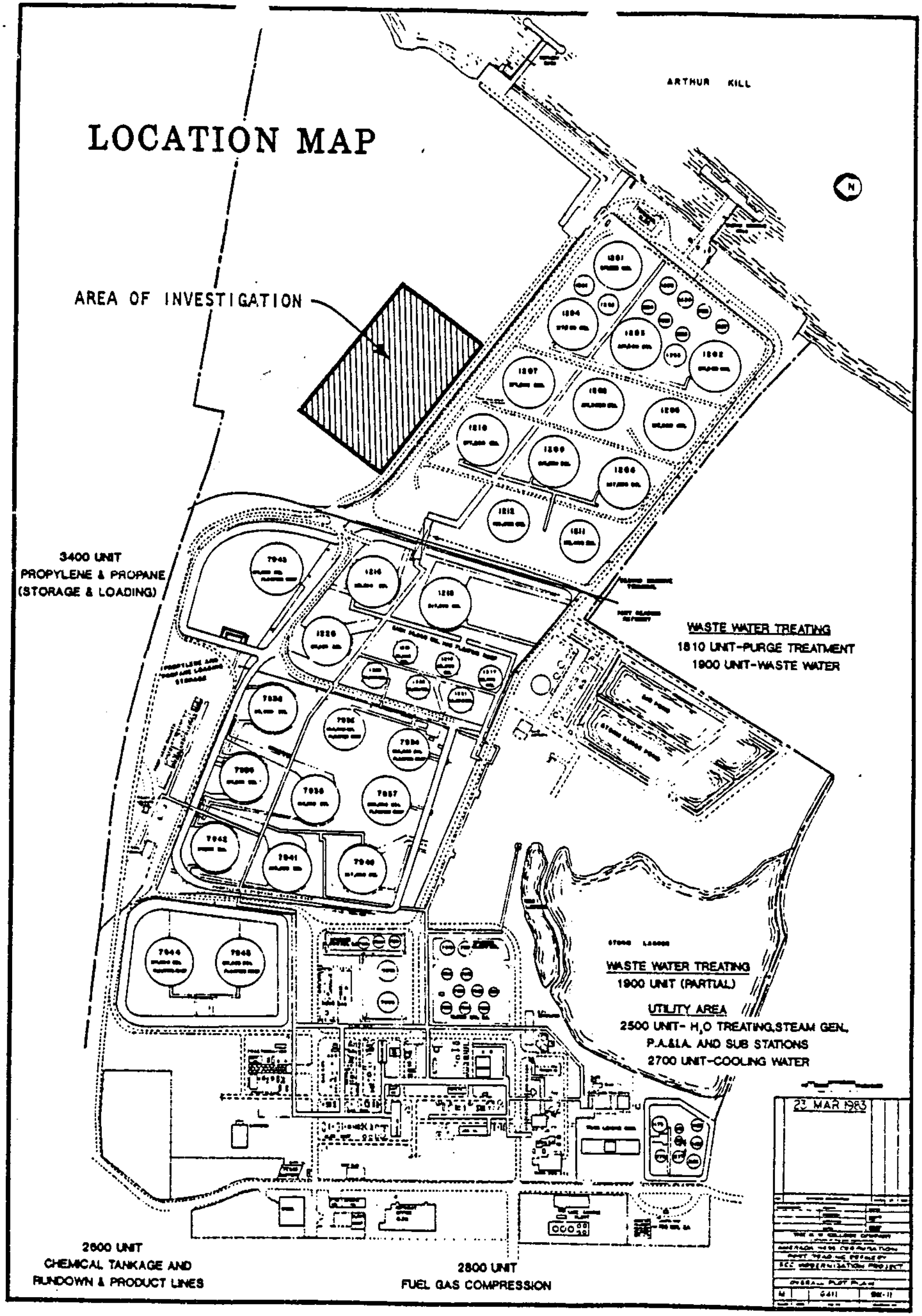
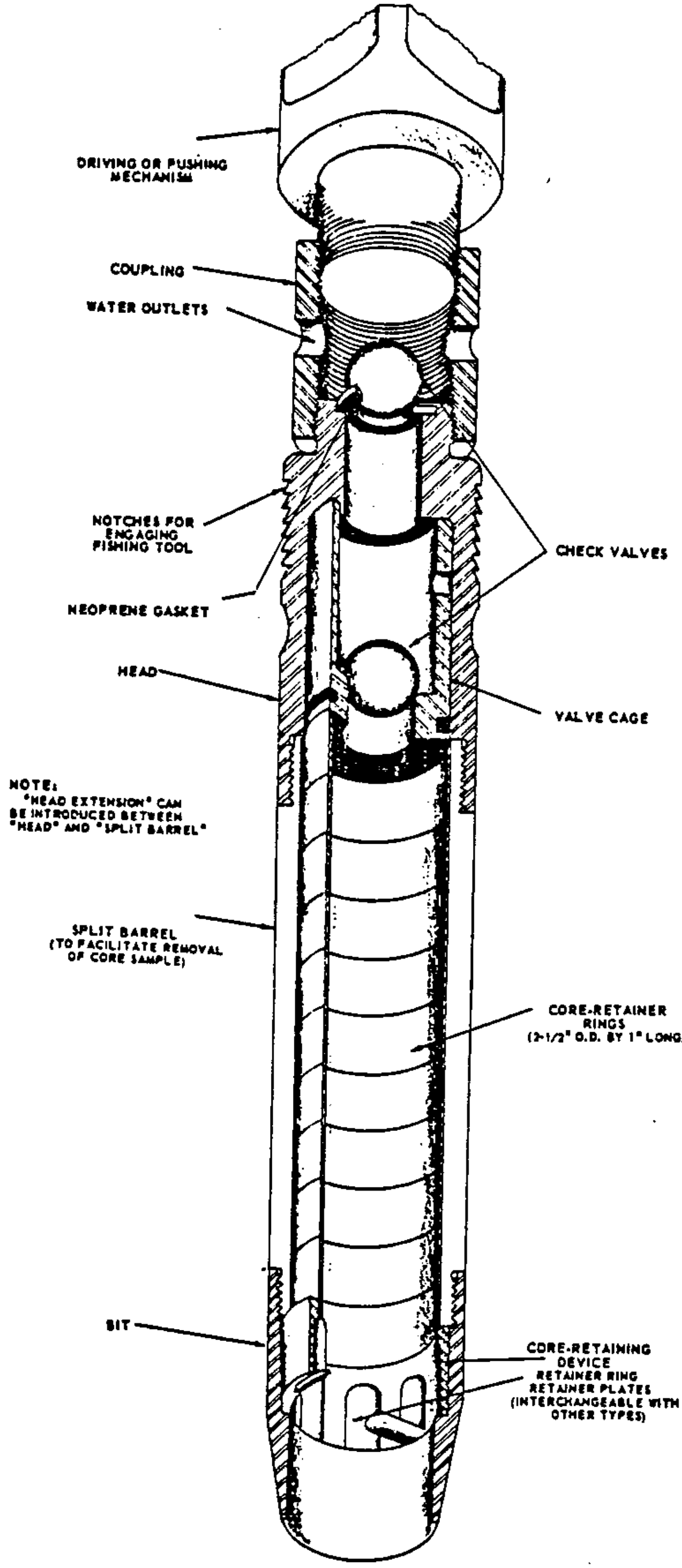

LOCATION MAP
ARTHUR KILL
AREA OF INVESTIGATION
3400 UNIT
PROPYLENE & PROPANE
(STORAGE & LOADING)
WASTE WATER TREATING
1810 UNIT-PURGE TREATMENT
1900 UNIT-WASTE WATER
WASTE WATER TREATING
1900 UNIT (PARTIAL)
UTILITY AREA
2500 UNIT- H2O TREATING,STEAM GEN.
P.A.&I.A. AND SUB STATIONS
2700 UNIT-COOLING WATER
23 MAR 1983
2600 UNIT
CHEMICAL TANKAGE AND
RUNDOWN & PRODUCT LINES
2800 UNIT
FUEL GAS COMPRESSION

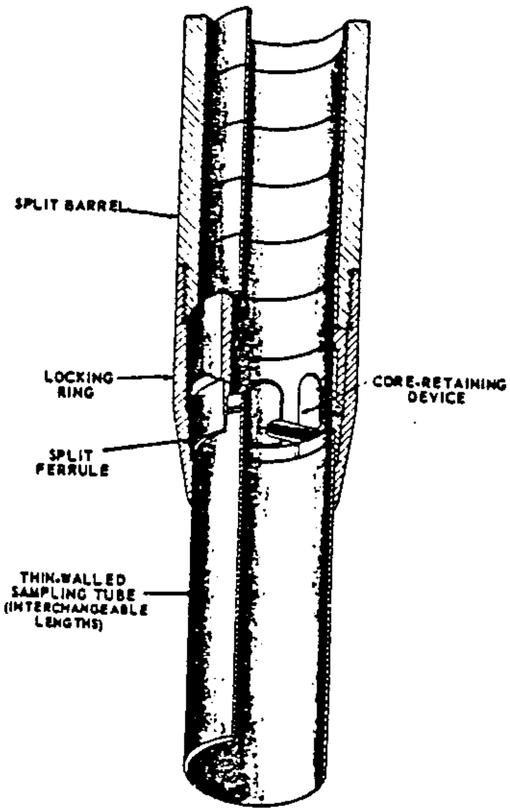
FIGURE 1

SOIL SAMPLER TYPE U

FOR SOILS DIFFICULT TO RETAIN IN SAMPLER

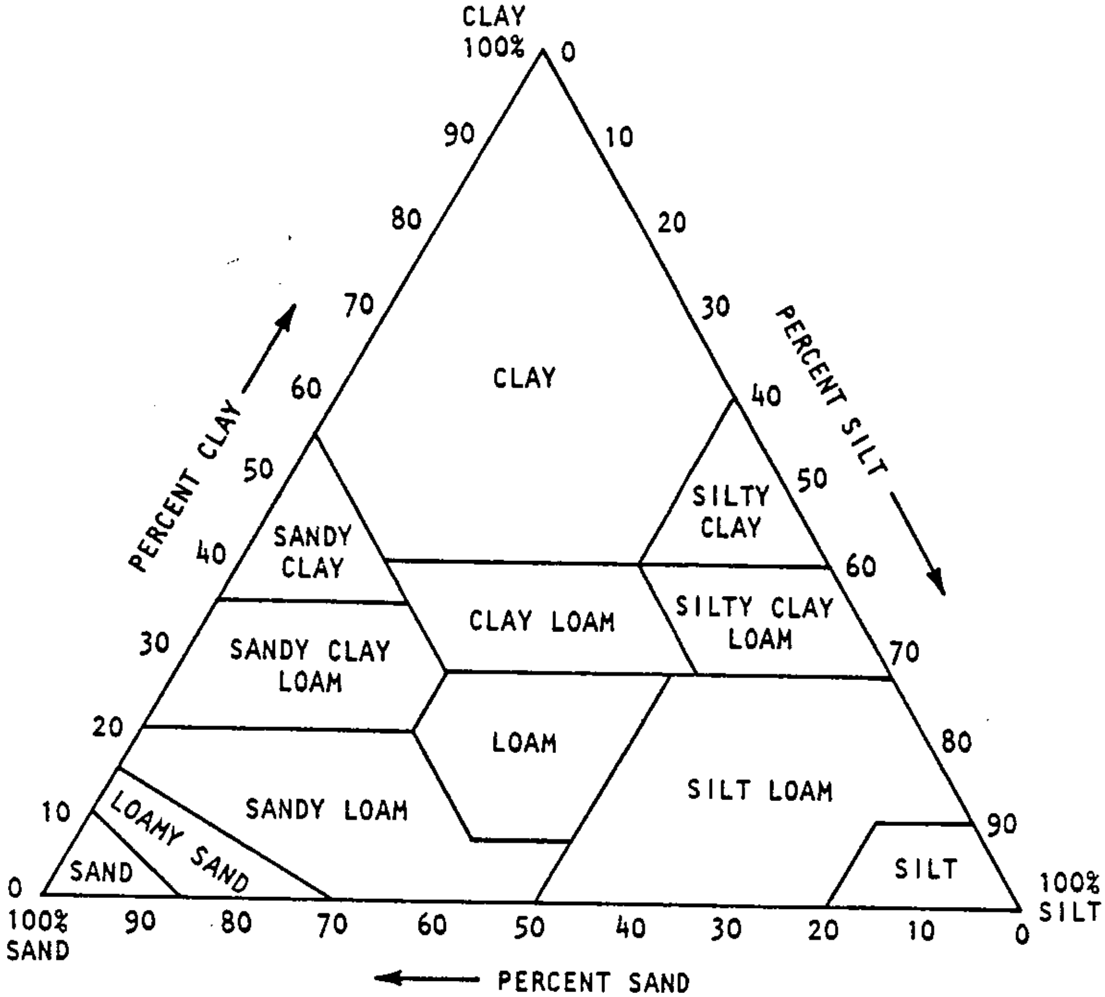


ALTERNATE ATTACHMENTS



DAMES & MOORE

FIGURE 3



U.S.D.A. TRIANGLE DIAGRAM USED FOR DETERMINING SOIL TEXTURAL CLASS

DAMES & MOORE

FIGURE 4A

MAJOR DIVISIONS			GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS	CLEAN SAND (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE				SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

UNIFIED SOIL CLASSIFICATION SYSTEM

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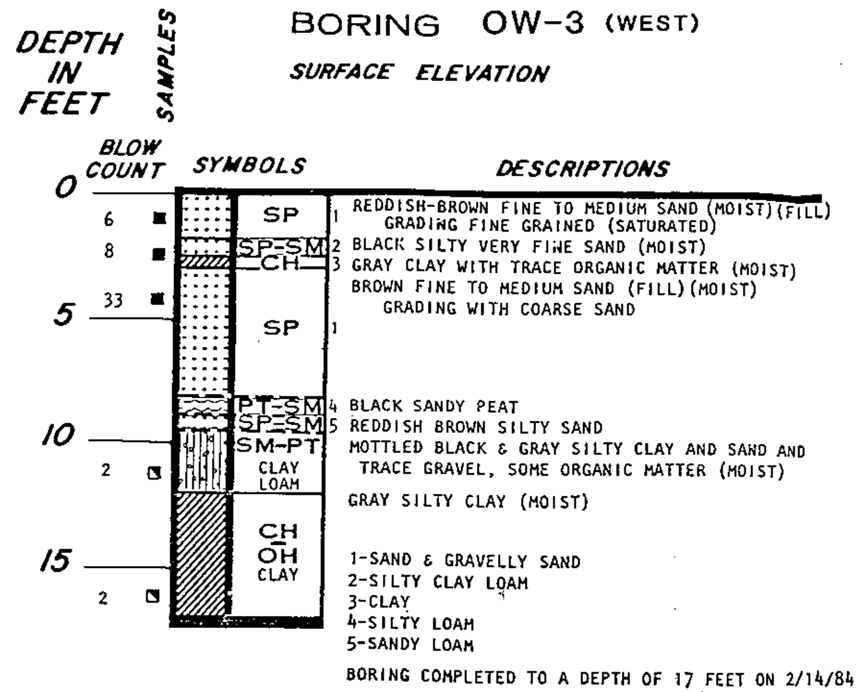
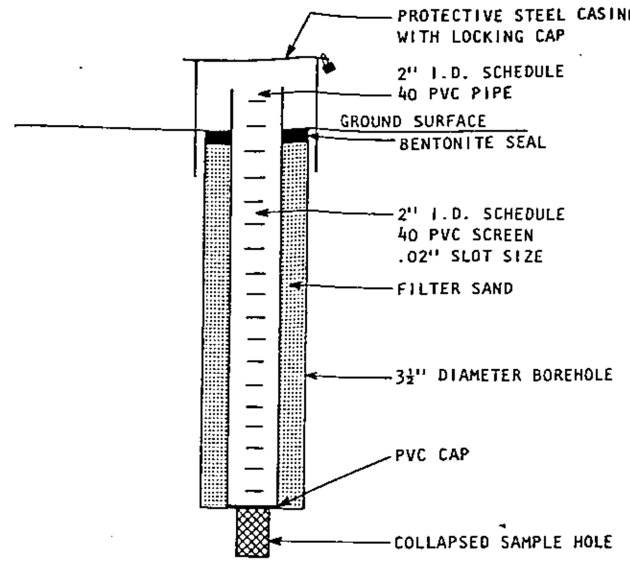
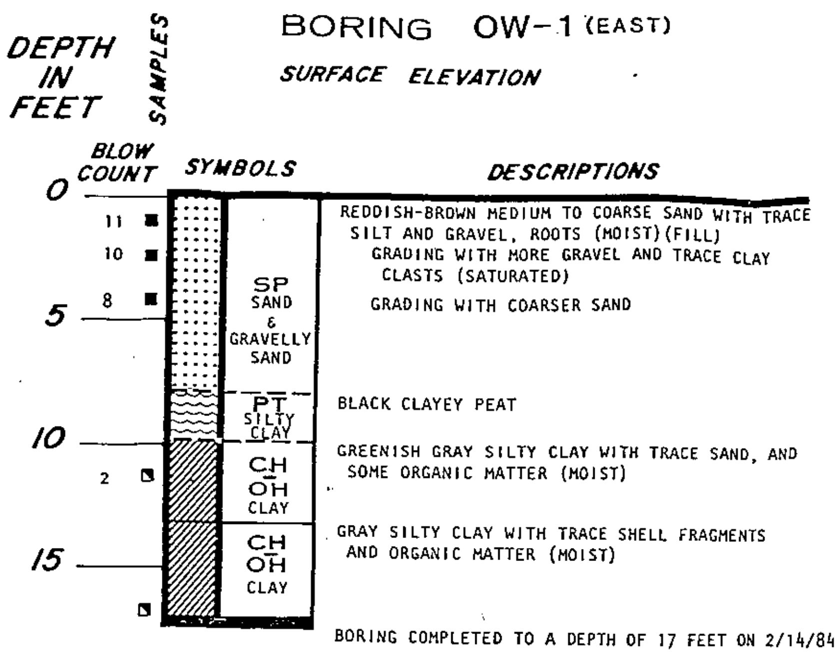
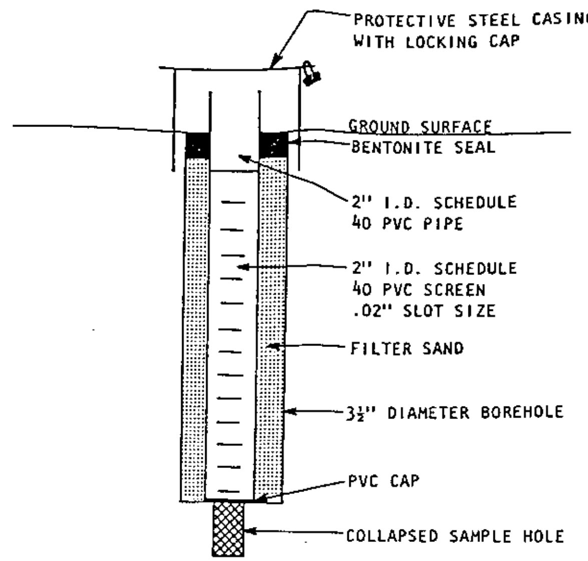
FIGURE 4





LOG OF BORING AND WELL SCHEMATIC





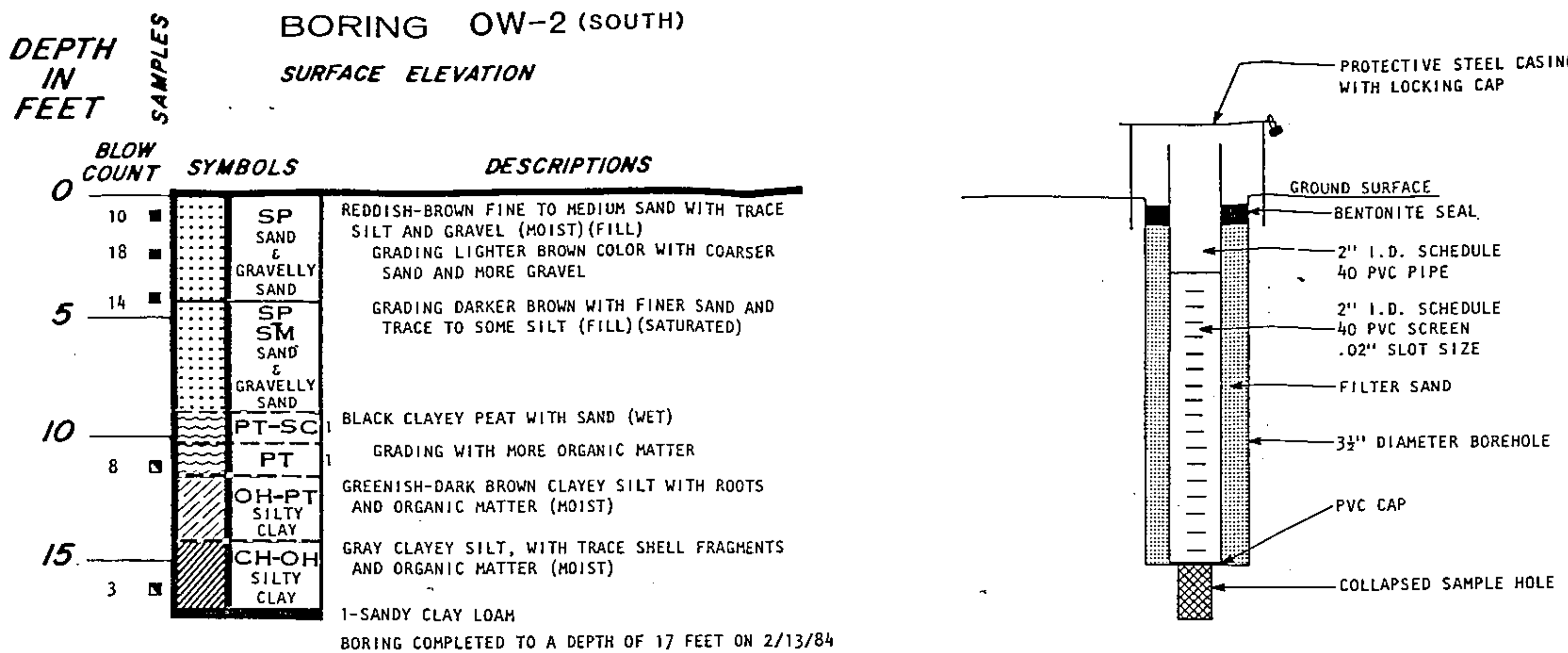
LOG OF BORING AND WELL SCHEMATIC

NOTES:

1. REFER TO TEXT FOR DISCUSSION OF STRATIGRAPHY AND TO FIGURE 2 FOR BORING LOCATIONS.
2. THE FIGURES IN THE COLUMN LABELED "BLOW COUNT" REFER TO THE NUMBER OF BLOWS REQUIRED TO DRIVE THE DAMES & MOORE SAMPLER (2½" I.D.) OR STANDARD SPLIT-SPOON SAMPLER (1½" I.D.) A DISTANCE OF ONE FOOT USING A 300 OR 140 POUND HAMMER FALLING APPROXIMATELY 30 INCHES.
   - ■ D&M SAMPLE
   - ◪ SPT SAMPLE
3. SYMBOLS IN BOLD TYPE ARE SOIL CLASSIFICATIONS BASED ON UNIFIED SOIL CLASSIFICATION SYSTEM AND THOSE IN LOWER FACE TYPE REFER TO U.S.D.A. TEXTURAL CLASSIFICATION. CLASSIFICATION OF THE TOP 5 FEET OF SOILS IS BASED ON SIEVE ANALYSIS AND CLASSIFICATION AT LOWER DEPTHS IS BASED ON VISUAL ANALYSIS OF SAMPLES AND/OR DULL CUTTINGS.

DAMES & MOORE

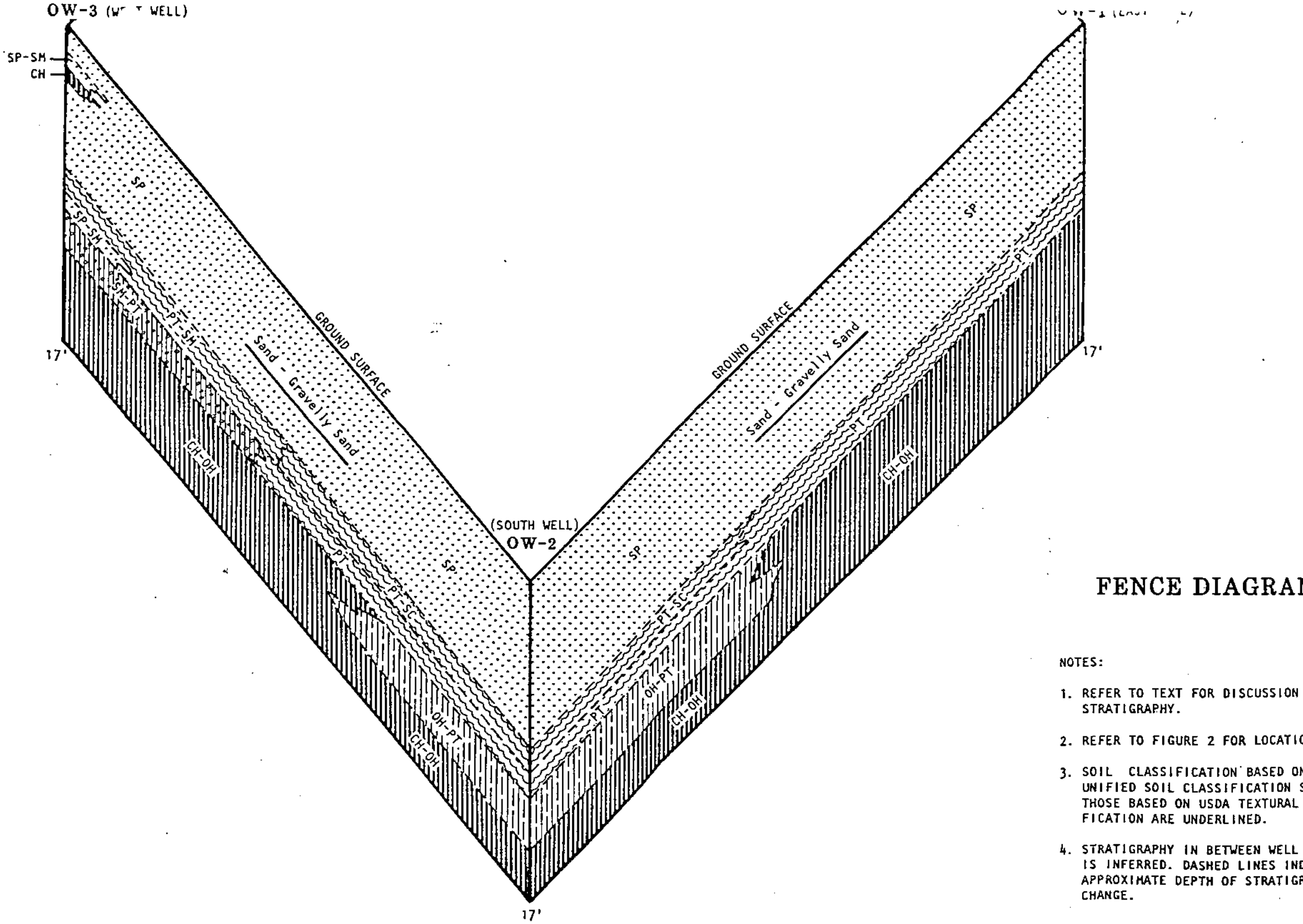
FIGURE 5



LOG OF BORING AND WELL SCHEMATIC

DAMES & MOORE

FIGURE 5A



FENCE DIAGRAM

NOTES:

1. REFER TO TEXT FOR DISCUSSION OF STRATIGRAPHY.
2. REFER TO FIGURE 2 FOR LOCATIONS.
3. SOIL CLASSIFICATION BASED ON UNIFIED SOIL CLASSIFICATION SYSTEM. THOSE BASED ON USDA TEXTURAL CLASSIFICATION ARE UNDERLINED.
4. STRATIGRAPHY IN BETWEEN WELL LOCATIONS IS INFERRED. DASHED LINES INDICATE APPROXIMATE DEPTH OF STRATIGRAPHIC CHANGE.

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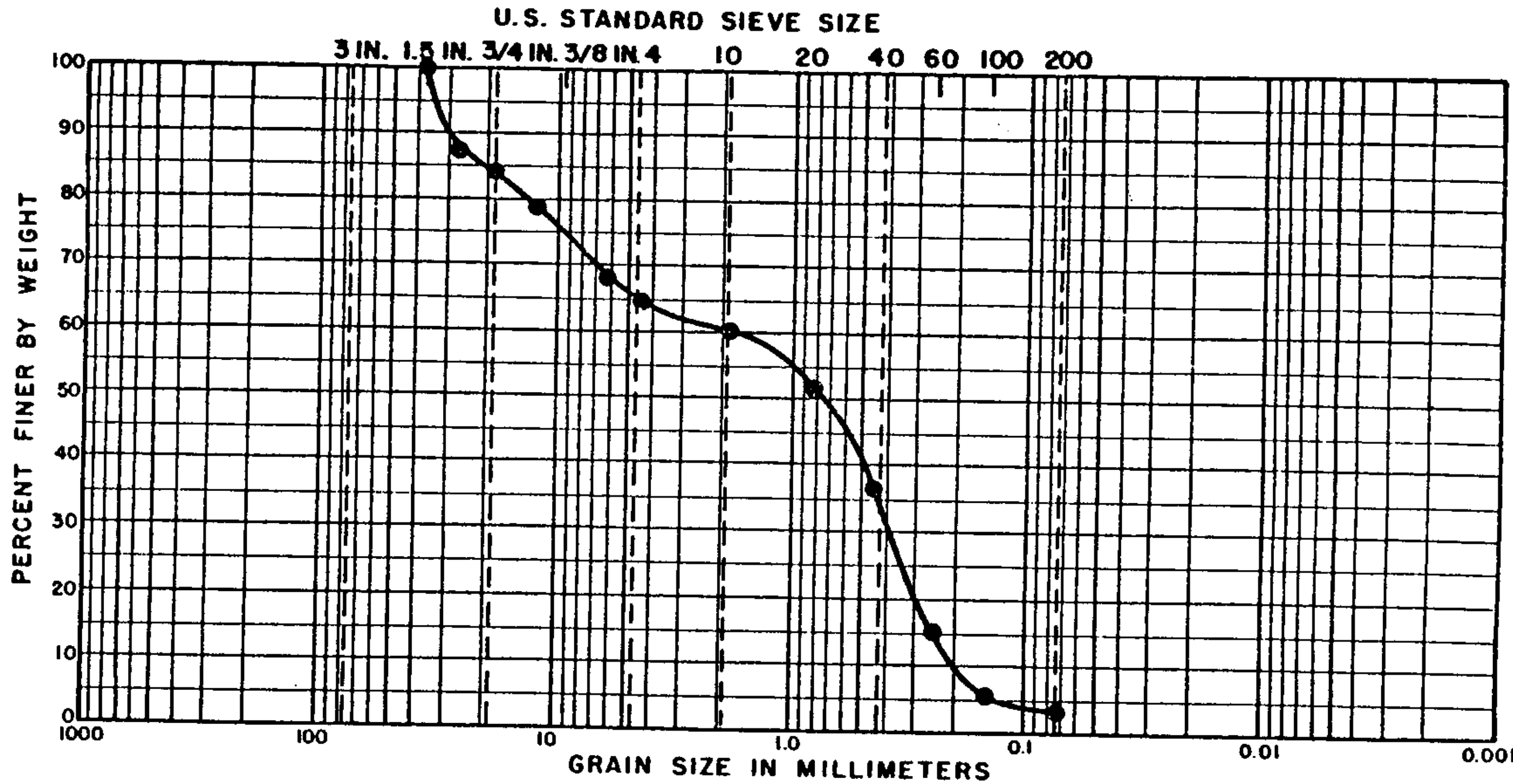
FIGURE 6



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

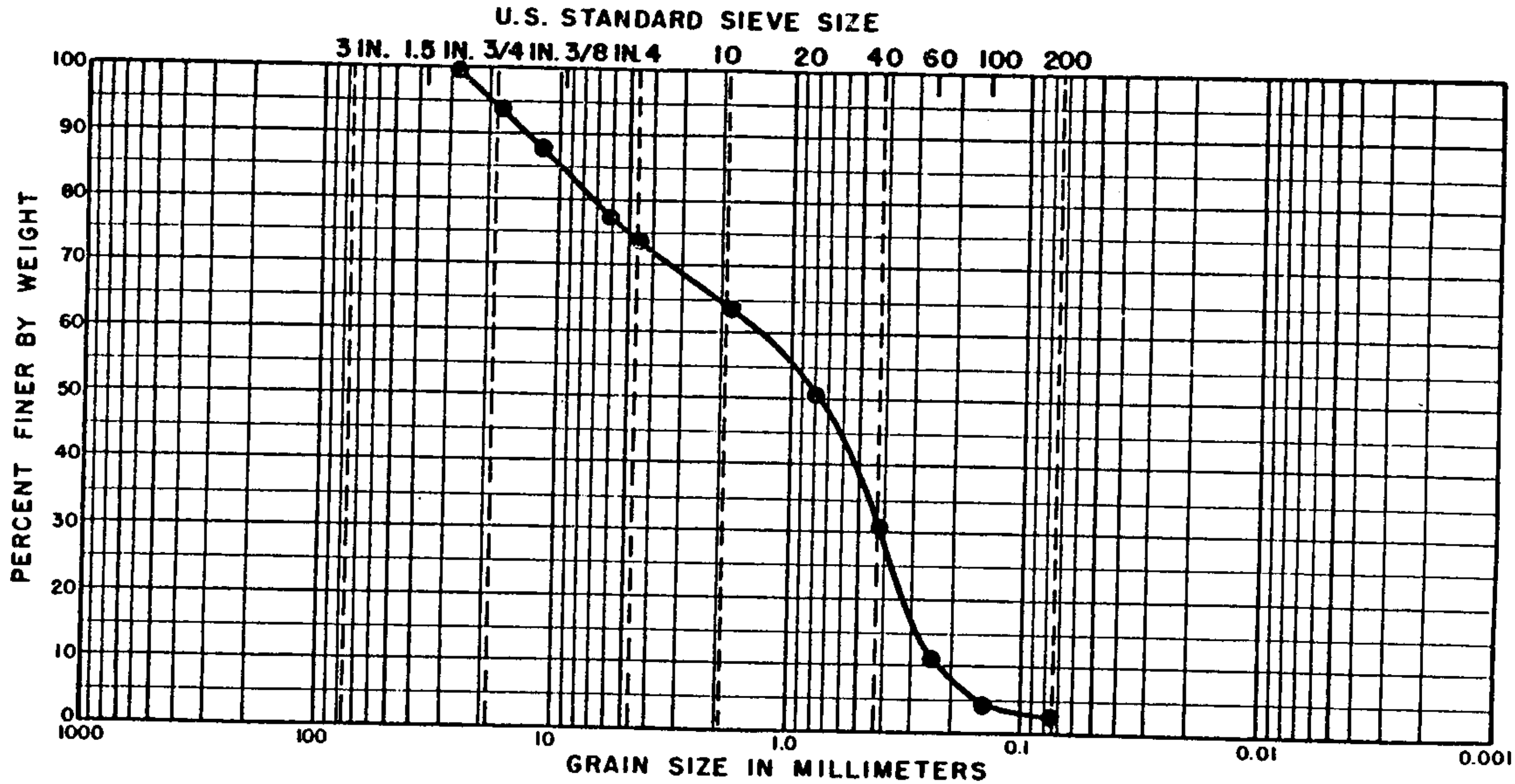
OW-1	DEPTH	CLASSIFICATION	NAT. WC	LL	PL	PI	
S-1	0-5'	SAND					

Dames & Moore

GRADATION CURVE

NOTE: SEE FIGURE 2 FOR LOCATION

FIGURE 7



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

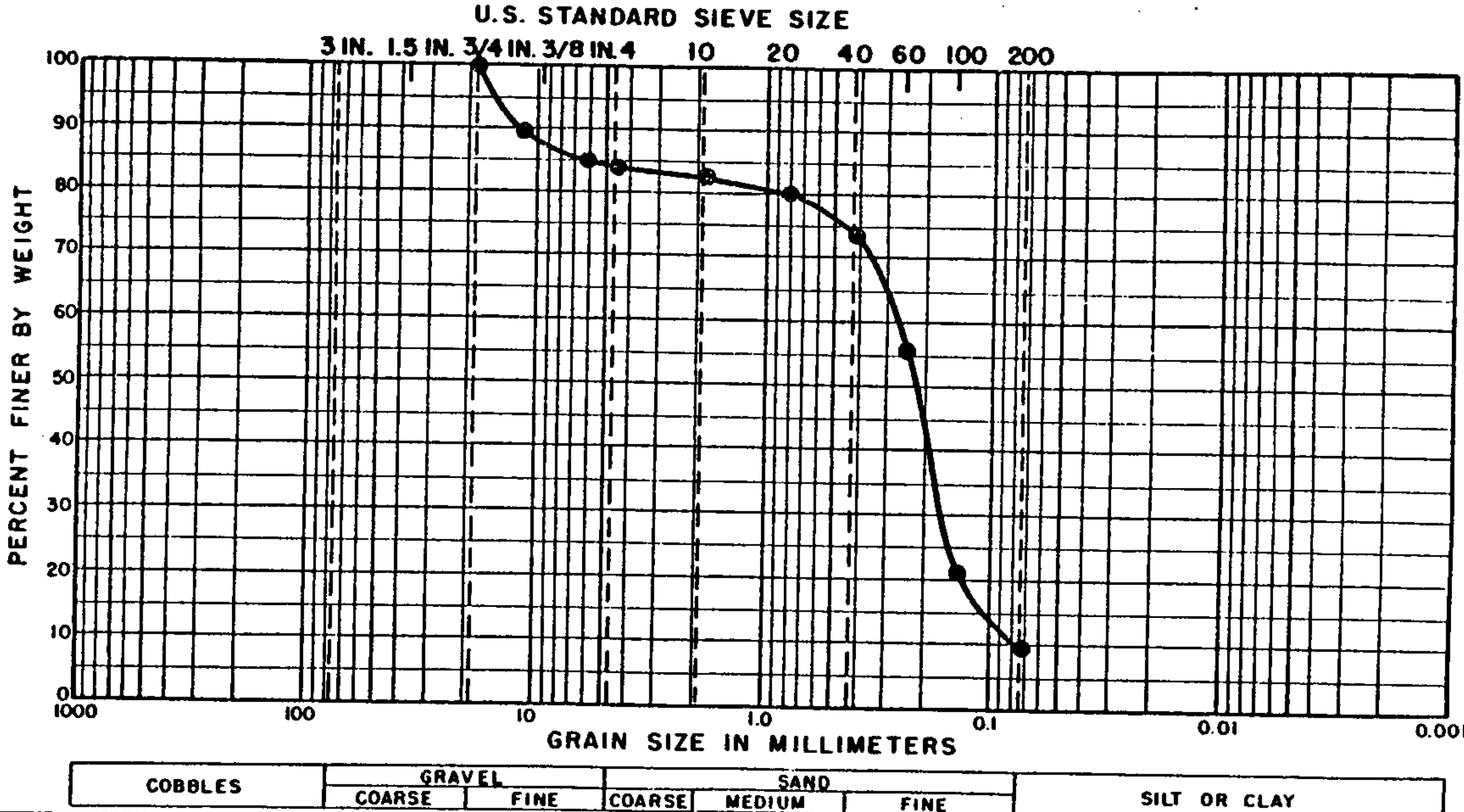
OW-2	DEPTH	CLASSIFICATION		NAT. WC	LL	PL	PI	
S-1	0-5'		SAND					

Dames & Moore

GRADATION CURVE

NOTE: SEE FIGURE 2 FOR LOCATION

FIGURE 8



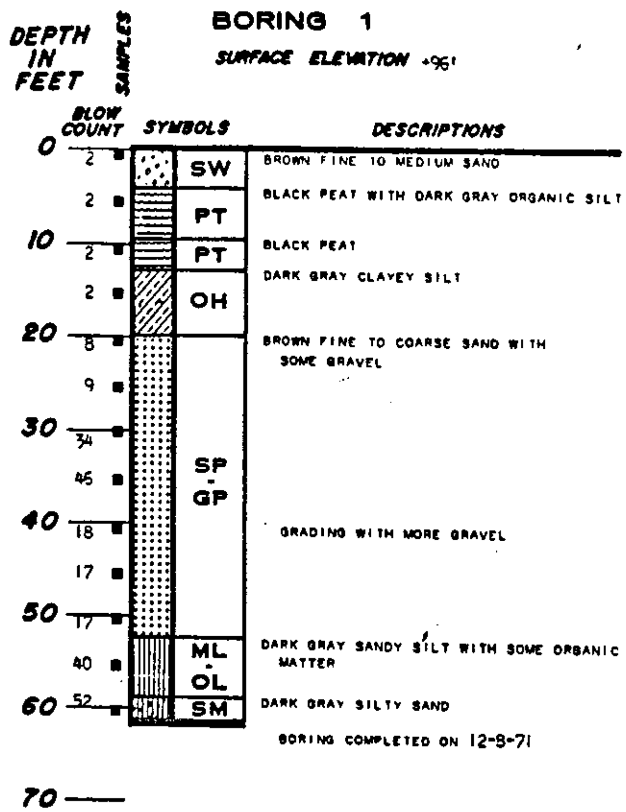
OW-3	DEPTH	CLASSIFICATION		NAT. WC	LL	PL	PI	
S-1	0-5'		SAND					

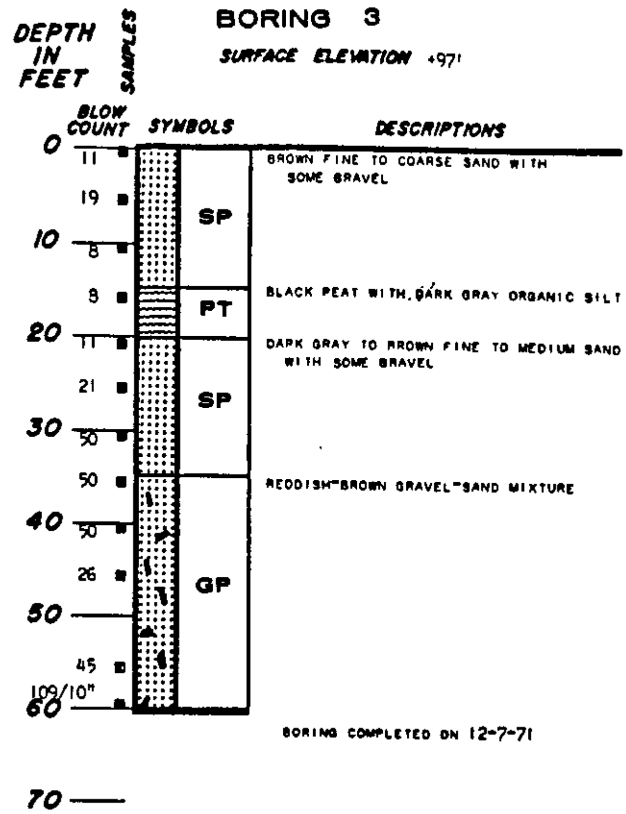
Dames & Moore

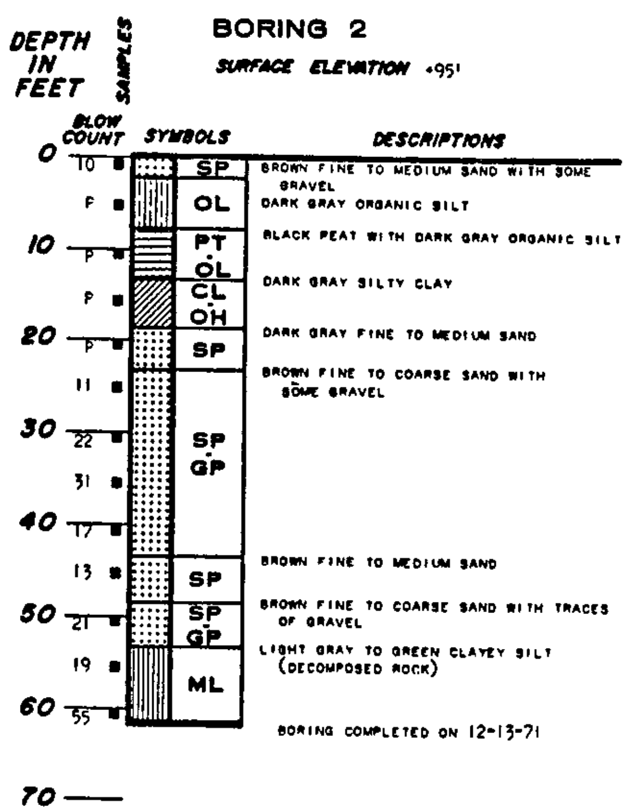
FIGURE 9

GRADATION CURVE

NOTE: SEE FIGURE 2 FOR LOCATION







NOTES:

THE FIGURES IN THE COLUMN LABELED "BLOW COUNT" REFER TO THE NUMBER OF BLOWS REQUIRED TO DRIVE THE DAMES & MOORE SOIL SAMPLER A DISTANCE OF ONE FOOT USING A 300-POUND HAMMER FALLING 30 INCHES. THE DAMES & MOORE SAMPLER IS 3¼" O.D. AND APPROXIMATELY 2½" I.D.

THE LETTER "P" IN THE "BLOW COUNT" COLUMN INDICATES THAT THE SAMPLER WAS ADVANCED BY THE WEIGHT OF THE DRILL ROD AND DRIVE WEIGHT WITHOUT DRIVING.

ELEVATIONS REFER TO AMERADA HESS CORP. DATUM.

THE DISCUSSION IN THE TEXT OF THE REPORT IS NECESSARY FOR A PROPER UNDERSTANDING OF THE NATURE OF THE SUBSURFACE MATERIALS.

LOG OF BORINGS

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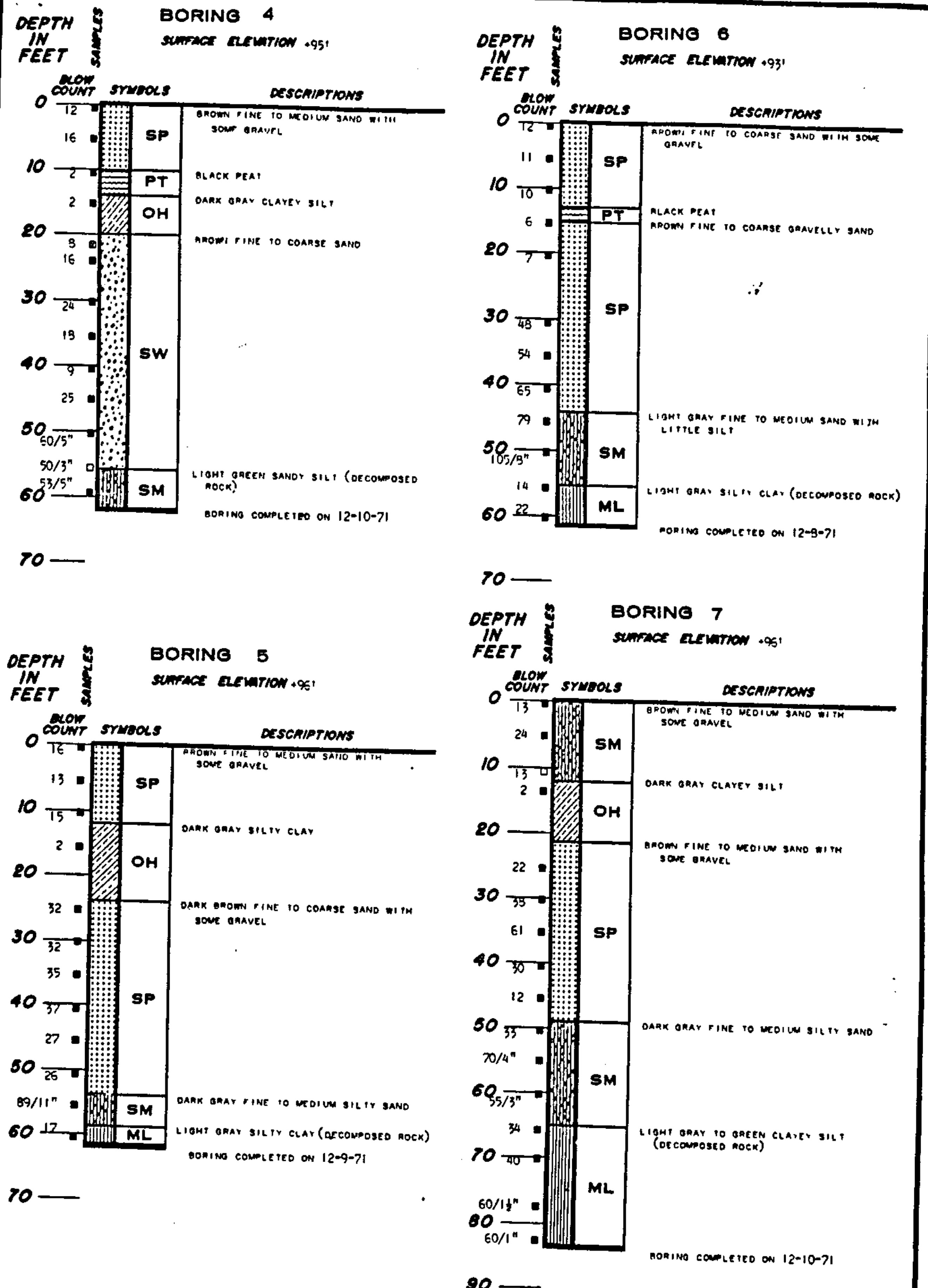
PLATE A-1A



LOG OF BORINGS

DAMES & MOORE

PLATE A-18

NO. 1 LANDFARM

TECHNICAL SPECIFICATIONS

PREPARED FOR:

AMERADA HESS CORPORATION

PORT READING REFINERY

PORT READING, NEW JERSEY

Job No. 6217

TABLE OF CONTENTS

Detailed Specifications

Section 3 - Concrete and Reinforcing Steel

Section 4 - Site Preparation and Development

Section 5 - Basis of Payment

SECTION 1

GENERAL SCOPE AND SPECIAL PROVISIONS

1. Scope of the Work

The work to be accomplished under this contract consists of the furnishing of all labor, materials, equipment and services necessary for the construction of a sludge landfarm facility with adjacent oil-water separator as specified and shown on the Plans for the Amerada Hess Corporation located at its refinery in Port Reading, New Jersey.

The Owner may decide to furnish certain materials, equipment and/or services to the Contractor for incorporation into the project. All items to be furnished by the Owner and the details associated therewith will be provided in pre-bid documents to the Contractor.

2. Occupational Health and Safety Act

All work described under this contract shall be done in strict compliance with the Occupational Safety and Health Act of 1970 (P.L. 91-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (P.L. 91-54) as currently amended.

It is not the intention of these Specifications to conflict with these Acts in any way and, where conflicts may arise, the Act shall govern.

The Owner and Engineer shall not and will not be considered in charge of or responsible for acts of the Contractor, methods of construction, construction, construction progress, construction forces or equipment or safety procedures.

3. Execution and Coordination

It is intended that the work covered by this contract be done so as to cause minimum interference with the normal operation of the Owner's existing facilities and other construction work being performed at the refinery. The Contractor will be required to organize and schedule its work so as to keep the existing facilities in full operation during the construction period insofar as is consistent with the nature of the construction work to be performed.

The Contractor's work schedule will be subject to the approval of the Engineer and Owner. Although every effort will be made to cause the minimum amount of interference with the Contractor's work, the interest of the Amerada Hess Corporation in regard to the existing facilities and operations must always take precedence over the construction work. Therefore, the right is reserved by the Owner to temporarily shut down or modify the construction work and/or activities when it is deemed necessary.

The Contractor shall conform to all regulations and standards required by Amerada Hess Corporation for work being performed at the refinery site, including but not limited to, security procedures and safety standards. The Contractor will also report to a designated representative of the Owner and Engineer on a regular basis in order to keep each party advised of the work progress and of any problems that occur. The Contractor shall also coordinate its work and construction activities with any other contractor(s) working in the area.

4. Field Office

The Contractor is not required to have a field office. However, it must have a designated superintendent in charge of the project who can be reached by telephone, radio or in person during the construction period.

5. Lines and Grades

Hubs and reference points were set and two base lines established by the Engineer during a field survey for this project. The base lines are shown on the Plans together with the location of the hubs and their associated reference points.

The Contractor shall recheck the hubs establishing the two base lines and re-establish the base lines if required. The Contractor shall lay out the axes of the structures (basins) and set permanent hubs marking these lines. The Contractor will be furnished the location and elevation of a bench mark near the project area. The Contractor shall be responsible for all other lines and grades required.

6. Work On or Adjacent to Private Property

In connection with the work performed on or adjacent to private property, the Contractor shall take every precaution to avoid damage to the property owner's buildings, grounds and facilities and shall be completely responsible for the repair of damage to same. Fences, hedges, shrubs, etc., within the construction limits, shall be carefully removed, preserved and replaced when the construction is completed. Grassed areas disturbed by construction activities shall be graded, fertilized and seeded when construction is completed in accordance with the requirements set out hereinafter in these Specifications, if directed by the Engineer, or shall be replaced with new sod equal to existing sod at the Contractor's expense. When construction is completed, the property owner's facilities and grounds shall be restored to as good or better than their original condition.

A photographic log showing the condition of private property prior to construction is recommended, though not required.

Foundations adjacent to an excavation which is to be carried below the bottom of the foundation shall be supported by shoring, bracing or underpinning and the Contractor shall be held strictly responsible for any damage to said foundation.

7. <u>Existing Utilities</u>

Special precautions shall be taken by the Contractor to avoid damage to existing overhead and underground utilities owned and operated by the Owner or by public or private utility companies.

With particular respect to existing underground utilities, all available information concerning their locations has been shown on the Plans. While it is believed that the locations shown are reasonably correct, neither the Engineer nor the Owner can guarantee the accuracy or adequacy of this information.

Before proceeding with the work, the Contractor shall confer with the Owner and all public or private companies, agencies or departments that own and operate utilities in the vicinity of the construction work. The purpose of the conference, or conferences, shall be to notify said companies, agencies or departments of the proposed construction schedule, verify the lcoation of, and possible interference with, the existing utilities that are shown on the Plans, arrange for necessary suspension of service where possible, and make arrangements to locate and avoid interference with all utilities that are not shown on the Plans. The Engineer and Owner have no objection to the Contractor arranging for the said utility companies; however, the Contractor shall bear the entire responsibility for locating and avoiding or repairing damage to said existing utilities.

Where existing utilities or other underground structures are encountered, they shall not be displaced or molested unless necessary and approved by the owner of the facility and, in such cases, they shall be replaced in as good or better condition than found, as quickly as possible. All such utilities that are so damaged or molested shall be replaced at the Contractor's expense, unless in the opinion of the Engineer such damage was caused through no fault of the Contractor.

It is expected that the Contractor will be diligent in its efforts and use every possible means to locate existing utilities. Any claims for unavoidable damage, based on improper or unknown locations will be thoroughly examined in the light of the Contractor's efforts to locate the said utilities or obstructions prior to beginning construction.

8. Progress Schedule

The Contractor shall furnish for approval a suitable progress chart or schedule in graphical form showing the estimated schedule for the project. After approval, the Contractor shall keep the chart current showing actual progress on the project in relation to the estimated schedule.

9. Shop Drawings

The Contractor shall submit detailed shop drawings and material samples which shall include, but not be limited to, the following:

a. Reinforcing Steel

b. Piping, Valves, Gates, Hydrants and Drains

c. Manholes, Frames and Covers

d. Fencing

e. Clay and Sand for Landfarm Construction

f. Oil-Water Separator

Rejection of the same drawings on three separate occasions will constitute grounds for total rejection of the proposed equipment manufacturer or supplier as being unable or unwilling to meet these Specifications.

Shop drawings shall be checked by the Contractor and evidence of such checking shall be indicated thereon. The Contractor shall be completely responsible for accuracy, completeness, compliance with Plans and Specifications and compatibility, the Engineer's approval notwithstanding. Five copies of all shop drawings shall be submitted.

10. Materials or Equipment to be Furnished

Where materials or equipment are specified by a trade or brand name, it is not the intention of the Engineer to discriminate against an equal product of another manufacturer, but rather to set a definite standard of quality or performance, and to establish an equal basis for the evaluation of bids. Where the words "equivalent", "proper" or "equal to" are used, they shall be understood to mean that the item referred to shall be proper, the equivalent of, or equal to some other items, in the opinion or judgment of the Engineer. Unless otherwise specified, all materials shall be of the best of their respective kinds and shall be in all cases fully equal to approved samples. Even though the words "equal to" or other such expressions may be used in these Specifications in connection with a material, manufactured article or process, the material, article or process specifically designated shall be used, unless a substitute is approved in writing by the Engineer, and the Engineer shall have the right to require the use of such specifically designated materials, articles or process.

11. Supervision of Installation

All special equipment or materials under this contract shall be installed under the supervision of a qualified installation representative furnished by the manufacturer of such equipment or materials.

12. Utilities Required by Contractor

All electric current and/or any utility service required by the Contractor shall be furnished at its own expense except as noted hereinafter.

13. Water and Uplift

The Contractor shall, by the use of well points, pumps or other approved methods, prevent the accumulation of water in excavated areas. Should water accumulate, it shall be promptly removed. The Contractor shall also provide for dewatering areas adjacent to structures or lines to prevent uplift during construction operations. The Contractor will be held responsible for any damage due to uplift of such structures or lines and to existing structures during construction operations.

14. Blasting

All blasting operations including storage of explosives shall be in accordance with the municipal ordinances and state laws, and all explosives shall be stored in conformity with said ordinances and laws. No blasting shall be done within five feet of any water or gas main, except with the light charges of explosives. Any damage done by blasting is the responsibility of the Contractor and it shall promptly and satisfactorily repair such damage.

To implement these requirements and unless otherwise required by ordinance or law, each excavating crew shall be provided with two metal boxes with suitable locks. One of these boxes shall be for storing explosives and one for caps. The boxes shall always be locked except when in actual use. They shall be painted a bright color and stenciled with appropriate warning signs. At night, all explosives and caps shall be removed from the boxes and stored in a central magazine. Compliance with laws, ordinances and regulations shall be the Contractor's responsibility and it shall save the Owner and/or Engineer harmless from any and all claims of any type or nature arising from blasting or storage of explosives.

15. Permits, Codes, Agreements and/or Contracts with Private Utilities, Municipalities or Public Agencies

The Contractor shall make application for, obtain and pay for all licenses, permits, agreements and/or contracts with private utility companies, municipalities, or public agencies and shall pay all fees and charges in connection therewith.

16. Guarantee

The Contractor shall guarantee all materials, equipment and work for a period of one year from completion and shall comply with the applicable requirements of the General Conditions relating to the guarantee provisions.

17. Testing

Testing shall be by an independent laboratory paid for by the Contractor in accordance with the requirements of Section 2, "Testing and Control of Material" of these Specifications.

18. Bank Erosion

The Contractor shall maintain all areas where excavation and backfilling operations are being performed or have been performed in order that siltation and bank erosion will be kept to a minimum during construction.

19. Environmental Statement

During construction of the sludge landfarm, extreme care shall be exercised to protect graded and cleared areas. To accomplish this end, temporary grassing, berm ditches and containment dikes may be necessary to minimize the effects of runoff and erosion in the work areas.

20. Cleanup

Upon completion of the construction, the site shall be completely cleaned up. The Contractor shall keep the work site generally neat and free of excessive debris throughout the construction period.

21. Site Conditions

The sludge landfarm facility is to be built in an open area utilized primarily for storing materials utilized in an ongoing construction project at the refinery. The stored materials will be moved by others prior to commencing construction on the landfarm facility.

The Contractor shall visit the site of the work in order to insure that it is fully informed in regard to all conditions pertaining to the place where the work is to be done.

*   *   *

SECTION 2

TESTING AND CONTROL OF MATERIALS

1. Scope

This Section together with such additions, deletions, or modifications, if any, as may appear in any other particular section of these Detailed Specifications shall govern the furnishing and testing of materials to be used in the work.

Materials of construction, particularly those upon which the strength and durability of the structure may depend, shall be subject to inspection and testing to establish conformance with specifications and suitability for uses intended.

2. Cost of Tests and Selection of Testing Agencies

All materials and equipment used in the construction of the project shall be subject to adequate inspection and testing in accordance with accepted standards. The independent laboratory or inspection agency shall be selected by the Contractor subject to the approval of the Engineer. The Contractor shall pay for all laboratory inspection service direct, and as a part of this contract.

3. Sources of Supply

The Contractor shall submit a list indicating its source of supply of all materials, including manufactured items, and receive the Engineer's approval prior to the placing of orders. The Engineer may require representative samples of any materials prior to approval of the source. The Engineer's approval of the source of any sample shall not be construed to relieve the Contractor of furnishing materials which fully meet all provisions of these Specifications.

If it is found that sources of supply which have been approved do not furnish uniformly acceptable products, the approval may be withdrawn. The Contractor and its supplier shall afford the Engineer or its representative opportunities for inspecting products and materials at any time during their preparation. The Contractor and/or supplier shall furnish shipment thereof, without charge.

4. Approval of Testing Agencies and Reports

Whenever in these Specifications inspection and testing of materials is required, bureaus, laboratories, and/or agencies selected by the Contractor for such inspection and testing service shall be approved by the Engineer.

Six copies of all test reports shall be sent to the Engineer's home office for checking and distribution.

Test reports shall contain as a minimum (1) the name and location of the supplier's plant; (2) the name of the person gathering the sample; (3) the date of the sampling; and (4) such other like data as may be required by the Engineer.

5. Governing Specifications

It is the intention of the Engineer in the preparation of the General and Detailed Specifications to define properly the kind and quality of materials to be furnished. The standards and tentative standards of the American Society of Testing Materials (ASTM); standards of the American Waterworks Association (AWWA); standards of the American Standards Association (ASA); standards promulgated by the Federal Specification Board (Fed.Spec.); American Association of State Highway Officials (AASHO): the Federal Aviation Agency (FAA): or other such agencies may be referred to in these Specifications. Where such standards are referred to, said references shall be construed to mean the latest amended and/or revised versions of the said standard or tentative specifications unless specifically stated otherwise. In the selection of samples and the routine testing of materials, the testing laboratory shall follow the standard procedure as outlined by the ASTM, unless otherwise set out.

6. Extent of Inspection and Testing Service

It is intended that materials of construction, particularly those upon which the strength and durability of structures may depend, shall be inspected and tested to establish conformance with specifications and suitability for uses intended. The following paragraphs are a schedule showing the extent of testing and requirements and methods of reporting for various types of materials and equipment. If it is then found that this list does not cover all items that will require testing, then such materials shall be tested as directed by the Engineer.

7. Cement

Cement shall have been shipped from the mill not more than three months prior to receipt on the work.

a. Where the total project requirement is less than 200 barrels (one car) and the concrete is furnished by a ready-mix plant:

Test and certificate of specification conformance for each shipment shall be furnished from the manufacturer.

b. Where the total project requirement exceeds 200 barrels:

Tests shall be made on the entire cement requirement by an approved independent laboratory on car samples or bin (sealed) samples as may be required. ASTM Specification C-150-79 shall apply.

8. Fine Aggregate (For Use in Cement Concrete)

Fine aggregate shall consist of natural river sand except that in special cases the Engineer may approve manufactured sand. Sand mined from high land deposits will not be approved.

a. Where the total project requirement is less than 100 tons:

Standard tests shall be made in advance, in the field or laboratory, for suitability per ASTM C-33-78, Paragraphs 3, 4, 5, 6 and 10, and ASTM C-40-73.

b. Where the total project requirement is 100 or more tons:

Standard tests shall be made in advance of concreting by an approved independent laboratory per ASTM C-33-78, Paragraphs 3, 4, 5, 6 and 10, and ASTM C-40-73 on each fine aggregate proposed to be used. In addition, sand shall be tested for potential alkali reactivity as per ASTM C-289-71. Other tests being satisfactory, the aggregate may be used pending results of 28-day mortar strength tests.

9. Coarse Aggregate (For Use in Cement Concrete)

a. Where the total project requirement is less than 100 tons:

Standard tests shall be made in advance in the field or laboratory per ASTM C-33-78, Paragraphs 7, 8, 9 and 10, except that gradation limits shall be as set out hereinafter in Section 3, "Concrete Work" of these Detailed Specifications.

b. Where the total project requirement is 100 or more tons:

Standard tests shall be made in advance of concreting by an approved laboratory on each grading of each coarse aggregate proposed to be used per ASTM C-33-78, Paragraphs 7, 8, 9 and 10.

10. Advance Tests of Concrete Design Mix(es)

Before commencement of concrete placing and after approval of cement and aggregates, an independent laboratory shall make from a single batch for each proposed mix a set of six standard 6" cylinders per ASTM C-31-69 and cure in accordance therewith. Test two cylinders at seven days, two cylinders at fourteen days, and two cylinders at 28 days per ASTM C-39-71. Two beam flexure tests as per ASTM C-78-75 shall likewise be made and tested from the design batch.

The requirements for tests may be modified at the Engineer's discretion without prejudice to its later requiring same (if it becomes in doubt about the quality of the concrete) if less than 50 cubic yards are required.

11. Reinforcing Steel

a. A certificate of origin and affidavit will be required for all reinforcing steel.

b. Inspection and Certification:

Field inspection for section, rust, shape and dimensions plus certified test report for heat number(s).

12. Structural Steel

Inspection and Certification:

Visual inspection at the site and certified copies of mill test on heat number used in fabrication.

13. Brick

Inspection and Certification:

Visual inspection for shape, color, soundness, cracks and other imperfections. Certificates indicating compliance with absorption, flexure and compression requirements as set forth in ASTM C-67-66 or other designated specification.

14. Water, Sewer and Drain Pipe

All piping material for water, sewer and drain lines shall be visually inspected for defects and damage at the site per applicable ASTM or other designated specification.

The manufacturer shall furnish with each shipment of pipe certified test reports indicating compliance with applicable ASTM, AWWA, or other designated specification. Reports shall be dated and identify the pipe by size, specification designation, and such other identification to indicate that the test certificates are applicable to the pipe shipped.

The specific ASTM, AWWA or other applicable specifications to which the pipe must comply are designated in the sections of these Detailed Specifications specifying the various pipe materials.

The Owner reserves the right to have representative samples of pipe tested by an independent laboratory at any time during the course of construction.

* * *

SECTION 3

CONCRETE AND REINFORCING STEEL

1. Scope

This Section covers the materials, mixing, transporting and placing of all concrete and reinforcing steel including all labor, materials and equipment.

Where brand names or manufacturers are used in this Section, it is not intended that the use of products of equal quality and function by other manufacturers be prohibited. Concrete admixtures may be as furnished by Master Builders, Grace Construction Materials, SIKA Chemical Corporation, or approved equal. Concrete forms and accessories may be furnished by Universal Form Company, Dayton Sure-Grip and Shore Company, Heckman Building Products, or approved equal.

2. Class of Concrete

Concrete shall be two classifications as follows:

CLASS "A" - All concrete shall be Class "A" unless otherwise shown on the Plans. All reinforced concrete shall be Class "A". Class "A" concrete shall possess the following characteristics and/or proportions of materials.

Minimum Cement Content: 6.0 bags (564 pounds) per cu. yd.
Minimum 28 day Compressive Strength: 3750 psi - average of any three cylinders.
Anticipated 28 day Compressive Strength: 4000 psi.
Slump: Three and one-half to six inches in walls, columns and piers. Two and one-half to five inches in slabs, beams and footings.
Admixtures: Pozzolith "R" may be required where slow set is desired; where quick set is desired, Portland Cement content of 6.2 bags may be required. Air entraining agents are optional and subject to Engineer's approval.

CLASS "C" - Concrete used for anchors, kickers and encasement for pipelines, for subfoundations and mass fottings, and for fill shall be Class "C". No concrete containing reinforcement shall be Class "C". Class "C" concrete shall possess the following characteristics and/or proportions of materials:

Minimum Cement Content: 5.0 bags (470 pounds) per cu.yd.
Minimum 28 day Compressive Strength: 2500 psi - average of any three cylinders.

<u>Slump</u>: Five to eight inches for encasement. Two to four inches in subfoundations and sealing as per Paragraph 9d.
<u>Admixtures</u>: None required.

3. <u>Determination of Strength of Concrete</u>

Compressive strength of concrete shall be determined by use of standard six-inch diameter by twelve-inch test cylinders in accordance with ASTM C-39-71 and C-31-69, as currently amended.

4. <u>Concrete Design Mixes</u>

As independent commercial testing laboratory, approved by the Engineer, shall prepare a design mix for each Class "A" and Class "C" concrete and submit <u>five</u> copies to the Engineer for general approval of the proportions and materials. The design mix shall be accompanied by the quality tests of the materials which are proposed in accordance with Section 2, "Testing and Control of Materials", Paragraph 4, 7, 8 and 9. The sources of supply and the producer of the concrete, if a ready-mix plant, shall be subject to all the requirements of Section 2, "Testing and Control of Materials" and particularly to Paragraph 3, "Sources of Supply" thereof. After general approval of the materials and proportions, the tests required in Paragraph 10 of Section 2 shall be submitted for approval. No concrete may be placed prior to submission and approval of the design mix and of the test results.

5. <u>Materials for Concrete</u>

a. <u>Portland Cement</u>

Portland cement shall be of American manufacture and shall conform to the "Standard Specifications for Portland Cement" (ASTM C-150-79) of the American Society for Testing Materials, and shall be Type I unless otherwise specified. The same brand of cement shall be used throughout the job unless specifically waived in writing by the Engineer. For job site mixing, all cement shall be in sacks.

b. <u>Water</u>

Water used in concrete shall be clear and free from objectionable substances such as oil, acid, alkali, vegetable matter, clay or silt. Water of doubtful quality shall be tested in briquettes which shall reach a strength equal to that of similar briquettes made with water of known satisfactory quality.

c. Admixtures

Where directed by the Engineer, "Pozzolith" as manufactured by Master Builders Company shall be added to all Class "A" concrete in strict accordance with the manufacturer's directions. There shall be furnished a standard Master Builder's dispenser for the introduction of "Pozzolith" to the mix. A representative of the manufacturer must be present at the job site and personally supervise the installation of the dispenser and set up its operation. Reduction in the 28 day strengths will not be permitted.

An air entraining admixture equal to Master Builders MB-VI, Darex A.E.A. or Aerix, meeting the requirements of ASTM C-260-77 for Air Entraining Admixtures may be used, but is not required. Use of such admixtures is subject to the approval of the Engineer.

The amount of air entraining admixture to be used will be determined by the percent of air entrained in the concrete. The limits of air will be 5% $\pm$ 1%.

The concrete when an approved air entraining agent is used shall have a reduction in weight of nor more than three to six pounds per cubic foot as compared with concrete of the same consistency and cement content made without the use of the agent. The specified cement factor shall be maintained by adjusting the quantity of aggregate and water used to the satisfaction of the Engineer. Reduction in the 28 day strength as specified will not be permitted. The use of any other admixture will not be permitted without the written consent of the Engineer as to the admixture to be used and its proportion in the mix.

d. Fine Aggregate

Sand for concrete shall consist of clean, hard, durable uncoated particles, free from lumps of clay, soft or flaky material, loam, and organic matter. In no case shall fine aggregate containing lumps of frozen material be used. Fine aggregate containing appreciable quantities of mica, shale, slate or other soft grains shall not be used. It shall not contain more than two percent by weight of material which may be removed by the elutriation test. Sands which do not pass the standard colormetric tests shall not be used unless it can be shown that the failure to pass is caused by particles of lignite or coal. Fine aggregate shall conform to ASTM Standard Specification C-33, latest revision, with gradation as follows:

Screen	Percent Passing
No. 4	95 - 100
No. 16	45 - 95
No. 50	10 - 30
No. 100	2 - 10

Sand shall be tested for potential alkali reactivity as per ASTM C-289-71.

Only natural river sand or specially approved manufactured sand shall be used.

e. Coarse Aggregate

Unless otherwise specified, coarse aggregate may be either crushed limestone or crushed gravel. Coarse aggregate shall show no evidence of disintegration, and the weighted percentage of loss shall not be more than 10% by weight when subjected to five alternations of the sodium sulphate test for soundness. It shall be composed of clean, hard, durable, uncoated particles free from deleterious matter. Except for gradation, coarse aggregate shall conform to the requirements of ASTM Standard Specification C-33-78, latest revision. The coarse aggregate shall meet the following gradations for the various classes of concrete.

For Class "A" Concrete

Passing 1½" square laboratory sieve	100%
Passing 1" square laboratory sieve	90 - 100%
Passing 3/4" square laboratory sieve	50 - 75%
Passing 3/8" square laboratory sieve	10 - 25%
Passing No.4 square laboratory sieve	0 - 5%

For Class "C" Concrete

Passing 2" square laboratory sieve	100%
Passing 1½" square laboratory sieve	85 - 100%
Passing 1" square laboratory sieve	50 - 80%
Passing 3/4" square laboratory sieve	25 - 40%
Passing 3/8" square laboratory sieve	5 - 20%
Passing No.4 square laboratory sieve	0 - 5%

6. Proportioning of Materials for Concrete

During formulation of the design mix, the proportions of aggregate to cement for the grade of concrete specified shall be such as to produce concrete of proper workability. The proportion by dry weight of fine to combined aggregates shall be controlled between limits of 30 to 45 percent as directed by the Engineer, but the mix shall be so controlled as to use the minimum fine and the maximum coarse aggregate which will give a satisfactory and workable mix.

Measurement of cement, fine and coarse aggregate for all classes of concrete shall be by direct weight upon an approved type of scales. Water shall be accurately measured in gallons by equipment accurate to plus or minus five percent.

The weight of cement in unopened sacks as packed by the manufacturer will be considered to be ninety-four pounds per sack. The method of measuring the water shall be accurate and readily adjustable, so the proper ratio of water and cement in each batch may be secured. It is the intention of the Engineer to control rigidly the quantity of water in each mix and to get the densest possible concrete. The Engineer may require calibration of weighing equipment. Equipment for measuring water shall be checked and adjusted daily. If Pozzolith is used, the dispenser shall be checked daily.

7. Source of Supply of Concrete

a. General

Concrete to be placed in the work may be proportioned and mixed by the Contractor on the site of the work or may be proportioned and mixed in a "Ready-Mix" central plant. Either plant shall be subject to the Engineer's approval of equipment and adequacy prior to the commencement of concrete placement operations. Such approval may be withdrawn by the Engineer if the concrete becomes non-uniform or for other reasons. In the case of such withdrawal of approval, the Contractor shall either cause corrections necessary or obtain another approved source.

b. Mixing on Job Site

When concrete is to be mixed on the job site, the Contractor shall obtain prior approval of the equipment it proposes to use. Generally as a minimum, scales, bins and two concrete mixers will be required. The Contractor will be required to furnish all equipment necessary for the control of quality equal to or better than that obtained in an acceptable central plant. The Contractor shall designate one man of "Foreman" or "Superintendent" caliber to supervise the operations of its concrete plant and to maintain the necessary records and quality checks.

Minimum mixing time for mixers one cubic yard and less shall be one minute; for mixers having a capacity greater than one cubic yard, minimum mixing time shall be one minute plus fifteen seconds for each additional cubic yard or fraction thereof. Additional mixing time may be required.

c. Mixing at a Central Plant

The name and location of the proposed plant and its sources of materials shall be submitted to the Engineer for approval. The Engineer will inspect the plant facilities and proposed mixer trucks and make a determination as to whether they are adequate to meet the quality control required. The Engineer's determination in this case will be final and binding. The concrete shall be mixed and handled in accordance with the requirements of ASTM Specification C-94-78a except as otherwise specified herein. During the period of placing concrete, the Engineer shall be afforded free access to the plant for such inspections as it may deem necessary, including the stationing of a separate inspector at the plant during batching operations if deemed desirable. Moisture content of fine and coarse aggregate will be checked and compensated for prior to mixing.

(1) Loading Tickets

Loading tickets shall be initialed by the "weight man" (or the inspector) stating 1) the class of concrete; 2) the name of the project; 3) the time of the batching; and 4) the batch weights of each material including water. When the mixer truck arrives on the job site, a copy of the ticket shall be given to the inspector before the concrete is placed. Any additional materials added shall be noted.

(2) Transporting

Concrete shall be transported only in approved mixer trucks which will mix the concrete enroute. In extreme hot weather, when approved by the Engineer, the required amount of water may be added upon arrival of the truck at the job site in order to avoid pre-set of the mix enroute. Such approval requires close cooperation of all concerned and will be given only if equipment to accurately measure the water is available and only if strength and slump tests are found to be uniform; approval may be withdrawn for any reason including lack of cooperation. Concrete which reaches the job in a pre-set condition or fails to meet slump requirements will be rejected and shall be removed from the job site. No re-tempering with water or any other admixture will be allowed except in special emergencies and under the conditions set in Paragraph 8, "Retempering of Concrete".

8. Retempering of Concrete

The concrete shall be mixed only in such quantities as required for immediate use and shall be used while fresh and before initial set has taken place. Any concrete in which initial set has begun shall be wasted and not used in the work. The retempering of concrete which has partially hardened by the addition of any ingredient will not be permitted except in special emergencies. In such emergencies, the Engineer may permit water and portland cement to be added at the rate of five gallons of water per sack of cement.

9. Placing of Concrete

a. General

All concrete shall be placed in daylight. Concrete will be ordered only after the Engineer's representative has been notified and has inspected and approved the placement of reinforcing steel and the general condition of form work.

All water and accumulated debris shall be removed from forms and inspection holes shall be left in wall forms near the bottom for such purpose. For footings and on-grade slabs, water shall be diverted or otherwise removed. For walls, beams, columns and supported slabs, the forms shall be wetted with water so as to tighten joints. Runways, where used, shall be independently supported so as to prevent disturbance of the forms.

Concrete within any unit of work between construction joints shall be placed continuously so as to prevent "cold joints". New concrete shall be placed against each succeeding batch so as to build up a continuous monolithic "pour".

b. Cold Weather Placing of Concrete

No concrete shall be placed when the air temperature in a shaded area away from artificial heat is 40° F. and falling. Concrete may be mixed and placed under the conditions set forth herein if the air temperature in the shade is 35° F. and rising, provided the Contractor makes provision for heating to maintain 45° F. and there is a U.S. Weather Bureau forecast for 45° F. or above. When the air in the shade falls below 50° F., the mixing water shall be heated (maximum 140° F.) so that the temperature of the concrete when deposited is between 60° F. and 75° F. Several thermometers shall be maintained by the Contractor at the site of the work and placed as directed by the Engineer.

The Contractor shall supply sufficient heating equipment such as vented stoves and/or salamanders to keep the temperature of the air surrounding the concrete from falling below 45° F. until test speciments indicate the concrete has attained a compressive strength of 2500 psi or greater or for a period of five days. The Engineer may require additional heating units to be placed in operation if, in its opinion, the concrete might be endangered by an additional drop in air temperature. When the required heating period has expired, the concrete shall not be allowed to cool at a rate faster than 1° F. per hour.

c. Hot Weather Placing of Concrete

When the temperature of the air exceeds 90° F. or the average temperature for the period of placement exceeds 85° F. or is predicted by a U.S. Weather Bureau forecast to exceed said limits, special precautions are required. The temperature of the concrete shall not be allowed to exceed 90° F. Ice shall be substituted for mixing water prior to the addition of the other materials to mixer in order to maintain temperature. The ice shall be accurately weighed (8.33 pounds = 1 gallon) prior to its being placed in the mixer and the remaining mixing water reduced correspondingly. The temperature shall not be reduced below 65° F.

The maximum time allowed in the mixer by ASTM C-94-78a (either 300 revolutions or 1½ hours, whichever occurs first) shall be considered the acceptable maximum at air temperatures between +45° F. and +70° F. The following maximum allowables shall apply at various temperatures:

Average Air Temperature	Maximum Time or Revolutions
45° F. - 70° F.	1½ hours or 300
70° F. - 80° F.	1 hour or 200
80° F. - 90° F.	45 min. or 150
90° F. - 100° F.	30 min. or 100
100° F. -	No placing allowed

Extreme care shall prevail in the pouring of thin slabs and other thin sections. All forms, reinforcing steel and/or subgrades shall be wet with cool water as shall all mixers, chutes, etc. immediately prior to concrete placement. No puddles of water shall be present at the time of placement.

d. Placing Concrete in Foundations and Slabs on Grade

Whenever possible, all foundation excavations shall be pumped dry and concrete deposited in the open. If it is not possible to proceed in this manner, a seal of concrete of sufficient thickness to resist any possible uplift shall be deposited under water. After the seal has set sufficiently, the foundation shall be pumped out, and the balance of the concrete placed in the dry.

Slabs on grade shall be poured on a base of six inches of compacted crushed stone over which a vapor barrier of 4 mil polyethylene has been placed.

e. Placing Concrete in Forms

Concrete shall be conveyed immediately after mixing to the place in which it is to be deposited. The method and manner of placing shall be such as to avoid the possibility of segregation or separation of the aggregates or the displacement of the reinforcement. The concrete shall be deposited so as to bring the construction up level and, during the process, it shall be rammed, spaded, and agitated by satisfactory tools so as to produce a compact concrete of maximum density with all spaces or voids filled and presenting a smooth, unbroken surface, free from coarse aggregate or exposed honeycomb spaces when the forms are removed.

f. Chuting Concrete

If concrete is conveyed by chutes, the plant shall be of such size and design as to insure a practically continuous flow in the chute. The chute shall discharge into a satisfactory storage hopper close to the point of deposit before the concrete is placed in the forms. The slope of the chute shall be such as to allow concrete of a satisfactorily dry consistency to flow without separation of the ingredients and, in no case, shall be flatter than one vertical to two horizontal. The chute shall be thoroughly flushed with water before and after each run, discharging outside of the forms. Should stoppage occur in the chute during concreting and the use of water be required to clean it, the water and all material removed from the chute shall be wasted outside the forms. If, in the opinion of the Engineer, the arrangements for chuting are such as to preclude the securing of watertight, smooth, dense concrete in any portion of the work, other and satisfactory means of transporting concrete shall be employed by the Contractor.

g. Vibrating Concrete

All concrete shall be vibrated in the forms as it is placed with mechanical internal vibrators maintaining 5,000 impulses per minute and approved by the Engineer. At least one extra vibrator in operating condition shall be maintained at the job site in case of emergency.

10. Curing of Concrete

a. General

All concrete shall be protected from too rapid drying or curing by the covering of surfaces with wet burlap, curing compound as per ASTM C-309-74 - Type I, or other suitable means immediately after finishing, concrete shall be kept moist for a sufficient period of time to insure satisfactory curing as directed by the Engineer, normally three consecutive days.

b. Cold Weather Curing

If concrete is placed in cold weather, the Contractor shall provide the necessary heat to insure that the temperature of the air immediately surrounding the fresh concrete does not drop below 45° F. at any time, at any place, and that the concrete is uniformly kept warm until the concrete has obtained a compressive strength of 2500 psi or greater and for at least five days. The variations in temperature shall not exceed 10° F. and no hot air shall be allowed to blow directly upon the fresh or curing concrete. The surfaces shall be protected from frost by covering with polyethylene at any time the temperature is forecast to drop below 50° F. The polyethylene shall not be allowed to touch the surface of the concrete.

c. Hot Weather Curing

During the curing of concrete in hot weather, all surfaces shall be kept covered with burlap and kept moist for a period of five days after placing, after which the protective covering shall be allowed to gradually dry out, but shall not be removed until the eighth day.

The most extreme care shall be exercised to maintain a moist surface on slabs during the first 24 hours after placement, and the Engineer, during periods of low humidity compounded by surface winds, may require continual wetting of the surface for a period of 24 hours. After the first 24 hours, the surface shall be wet down when work is begun in the mornings and left wet in the evenings with wetting in between if required.

11. Joints in Concrete

a. General

The unit of operation shall be as shown on the Plans and/or approved "concrete placing plans" between construction joints. In general, a unit shall not exceed thirty feet in each direction nor more than 900 square feet, although the Engineer may approve larger pours when same are submitted in five copies under the same procedure outlined for shop drawings and are to be considered as a shop drawing.

Where a construction joint is made, laitance, all weak concrete, and foreign matter shall be removed from the concrete surface and projecting reinforcing steel and the concrete roughened.

On all joints except "expansion joints", the reinforcing shall be set to extend into subsequent sections of construction so as to make the work a monolith. Joints shall not be made except as the Engineer may indicate, approve, or direct to preserve the strength, facility of pouring, or watertightness of the structures. In general, the locations of the joints are shown on the Plans, but these shall be changed if the Engineer so directs. A period of at least 48 hours shall elapse between the placement of adjacent concrete units or pours.

b. Expansion Joints

An expansion joint is defined as a joint specially constructed to allow movement as shown on the Plans. Expansion joints shall be constructed in accordance with the details shown on the Plans utilizing steel plates, expansion joint filler (Servicised Products Corporation Code 1301), Hornflex Primer and Thiokol LP-32 sealant, and shall be watertight in water holding structures or dry wells.

c. Joints in Footings and Walls

Construction joints in footings and walls shall be located across areas of low shearing stress and shall be provided with keyways. Keyway details shall be as shown on the Plans or in special cases as directed.

d. Joints in Slabs and Beams

Construction joints shall be located near the middle of spans of slabs, beams, or girders, unless a beam intersects a girder at this point, in which case the joints in the girders shall be off-set a distance equal to twice the width of the beam. In this case, provision shall be made for shear by use of inclined reinforcement. Keyways shall be provided as shown on the Plans.

e. Waterstops and Watertightness

Dry wells and structures housing equipment shall be watertight with no visible leaks and no accumulation of water. Any visible leaks shall be repaired to the satisfaction of the Engineer.

Waterstops consisting of 8-inch wide by 1/8-inch thick steel plates made continuous and watertight by continuous weld of the joints shall be placed as shown on the Plans. Certain waterstops may be shown on the Plans as copper for special reasons. Keyways with eight-inch wide, sixteen ounce copper waterstops for construction joints shall be used where such joints are shown and shall be soldered watertight.

f. Mastic Joints

Where joints sealer or mastic joint is noted on the Plans, the joints shall be sealed with the material designated on the Plans. All materials shall be installed in strict accordance with the manufacturer's instructions, and under the supervision of a qualified representative of the manufacturer. All surfaces and slots in concrete shall be provided as required by the manufacturer of the joint material.

12. Forms for Concrete Work

a. General

The requirements as set forth in this Paragraph are not obligatory, and may be modified at the discretion of the parties. If the Contractor desires to submit a different plan or schedule for forming, which in the opinion of the Engineer, will effect as good or better results, then at its discretion the Engineer may approve the Contractor's method of forming. Such approval will be for the benefit of the Contractor and will be based on the acceptability of the finished work. In no case will the Engineer pass on or be responsible for the structural adequacy of the Contractor's forms, falsework or other construction procedures.

If required, forming plans shall be submitted by the Contractor and approved by the Engineer before the forms are on the work. Forms shall be substantial and sufficiently tight to prevent leakage of mortar. They shall be properly placed or tied together so as to maintain position and shape and insure safety to workmen and passersby. Temporary openings shall be provided where necessary to facilitate cleaning and inspection immediately before depositing concrete. In no case shall concrete be placed in any form until inspected and approved by the Engineer. The Contractor shall be completely responsible for the strength and adequacy of its form work and shall save the Owner and/or Engineer harmless from any claims arising therefrom for any reason.

b. False Work

All false work shall be solely the Contractor's responsibility as to strength, line and grade, etc., but the Engineer may disapprove work which is unworkmanlike or, in the opinion of the Engineer, will not yield the finished product required.

c. Material for Forms

The forms for the outside face of all exposed surfaces shall be of not less than 1½" tongue and grooved lumber dressed on both edges and on the face next to the concrete, or 3/4" plywood panels, unless otherwise shown on the Plans or specifically permitted by the Engineer. Forms for all other concrete work may be constructed with 1" x 6" tongue and grooved sheathing or 1" ship-lap. Where shown on the drawings or required in these Specifications or by the Engineer, forms for all exposed walls, both inside and outside, shall be constructed of 3/4" plywood or lined with nonwarping fiberboard or plywood which, in all cases, must be approved by the Engineer.

Moldings and the ornamentation shown on the Plans shall be formed with wood or metal molds. The width of all boards used for such work shall be approved by the Engineer.

All studding shall be 2" x 4" lumber in structures up to 10 feet in height. For structures exceeding ten feet in height, 2" x 6" studding shall be a minimum size of studding and size and spacing of walers shall be approved by the Engineer. Walers shall be formed of double members.

d. Unlined Forms

Unlined forms may be used on unexposed surfaces of walls, slabs, columns and beams unless otherwise specified herein or as shown on the Plans. Form boards shall not be reused in contact with exposed surfaces unless they are thoroughly cleaned and oiled and approved by the Engineer.

e. Lined Forms

Where specified herein or where shown on the Plans, plywood panel or lined forms will be used for certain portions of concrete masonry structures. Where lined forms are used, the lining shall be of fiberboard or plywood which must, in all cases, be approved by the Engineer. All lining materials shall be used in as wide pieces as a single width of fiberboard. The lining materials shall be nailed to the backing beginning at the center of the board and working toward the edges to prevent buckling. Cigar box nails or similar nails with thin flat heads shall be used to attach lining material to forms. The edges of the linings shall be butted tight together, and joints between the sheets shall be filled with a compound of litharge or Rutland Patching Plaster, or approved equal. Lining material may be reused if it is satisfactorily cleaned and approved by the Engineer.

The smooth side of the lining materials shall be placed next to the concrete surface where smooth surfaces are specified. Where granular surfaces are indicated or specified, the rough surfaces of the lining materials shall be placed next to the concrete.

f. Steel Forms

The use of steel forms as furnished by the Economy Forms Corporation, Des Moines, Iowa, or approved equal, may be used when specifically approved in writing by the Engineer. Ties used with steel forms shall be of the type designed to remain permanently in place and conform to the the requirements for form ties hereinafter. Steel forms, if used, shall be placed under the direction of a trained and competent representative of the supplier.

g. Form Ties

Approved form ties shall be used for all wall construction. The ties shall be of the type that snap back in the wall, or permit removal of the tie ends. Ties shall be adjustable to permit tightening of forms, and of such type that will require a minimum amount of pointing with no metal closer than ½" from face of wall. No ties shall be permitted that require more than 1½" for pointing. Removal or pull-out type ties will not be permitted under any circumstances. Form ties with 3/4-inch wood concrete snap ties shall be as manufactured by the Universal Form Company of Chicago Illinois, or approved equal.

h. Wetting and Oiling Forms

Wood forms shall be given a coat of approved liquid form oil. All lined forms shall be greased with an approved form oil or with a good grade of cup grease thinned with gasoline or kerosene. Pressed wood form lining shall be given a coat of shellac before being greased. In all cases, care shall be used to remove all excess oil or grease. Oil used on forms for exposed concrete work shall be nonstaining form oil.

i. Removal of Forms

Forms shall not be removed until the concrete has attained a strength sufficient to support itself and the superimposed loads. Under normal curing conditions (average temperature 50° F. or above), the forms may be removed after following minimum time as elapsed:

Floor slabs, beams and girders - 10 days
Columns, pedestals and wall lifts over ten feet - 4 days
Columns and wall lifts under ten feet - 2 days

In cold weather, forms shall not be removed from any work when the danger exists of freezing the concrete or otherwise damaging the surface. Whenever a question exists as to removal of forms, the forms shall not be removed until a standard cylinder cured on the site in a manner similar to the work represented has attained a compressive strength of 3000 psi.

The use of the foregoing table shall in no way relieve the Contractor of its responsibility for the safety and integrity of the structure.

13. Sleeves and Inserts

The Contractor shall be responsible for placing all sleeves, floor drains (which shall be placed one inch low and the floor sloped thereto), wall castings, step nosing, and other inserts in the concrete walls and floors in their proper positions. If for any reason said sleeves, wall castings, and/or other inserts are not delivered prior to pouring, the Contractor shall box out for same in a manner acceptable to the Engineer. It shall then become the responsibility of the Contractor to place same and make a watertight closure of the openings in a manner satisfactory to the Engineer.

14. Concrete Finish

a. Floor Slabs

The concrete floors of all structures shall be finished monolithically with an allowable variation of 1/8" in ten feet transversely and longitudinally.

Concrete floor slabs on grade shall be placed over a well tamped and compacted subgrade. Form all recesses for thickened slabs, as shown on the Plans, and thoroughly compact stone. Lay vapor barrior of 4 mil (.004 inch) thickness Visqueen or Sisalcraft paper overfill. Vapor barrier shall follow the contour of slab.

All floor drains shallbe set one inch lower than grade and the slab pitched thereto. Screeds will be used to insure a uniform slope from the wall line to the floor drain.

Slabs to receive quarry tile shall be finished by tamping the concrete with special tools to force the agate away from the surface, then screeded with straight edges and floated to produce a reasonably true and uniform surface. All slabs except those receiving quarry tile shall be hardened with A.C. Horn's four in one clearseal.

b. Walls, Beams, Ceilings and Columns

(1) General

All concrete walls, ceilings and beams shall be pointed; those which are to be exposed permanently to view, including the interior of basins to a point 12 inches below the water line, shall be pointed and rubbed. If the surface is to be painted, it shall be left smooth and all loose concrete rubbed away by use of rough burlap sacks. If the surface is not to be painted, it shall be rubbed as hereinafter specified. Foundation walls shall be rubbed to a point one foot below grade on the outside. All projecting fins shall be removed from the concrete and holes left by form ties shall be pointed up.

(2) Pointing

When the concrete has set sufficiently, forms and form ties shall be removed and all depressions or imperfections inspected by the Engineer. After the Engineer has approved the general integrity of the work, all imperfections shall be wetted and repaired with nonshrink sand-cement mortar.

(3) Rubbing

After pointing has set, all surfaces requiring rubbing shall be kept wetted with water with a brush and rubbed with a No. 20 carborundum stone. The rubbing shall be continued sufficiently long to remove all marks and projections, producing a smooth, even surface without marked irregularities. The final rubbing shall be done with a No. 40 carborundum stone and continued until the entire surface is of smooth texture. After the rubbing has been finished, all excess particles shall be removed by brushing the surface with burlap. The finished surface shall be uniform in color and otherwise satisfactory to the Engineer.

c. Exterior Slabs

All walks, platforms and exterior floors or slabwork shall have a broomed finish. After screeding to the required grade while the concrete is still green, but has hardened sufficiently to bear the finisher's weight, the surface shall be floated with a wood float to a true and even plane with no coarse aggregate visible. The slab shall then be evenly broomed with all strokes parallel to leave a workmanlike skid resistant finish.

d. Chamfer

All exposed edges shall be chamfered 3/4-inch unless otherwise noted.

15. Watertightness

The Contractor is required to make watertight concrete in all structures holding water or solutions. All cracks and imperfections developing at any point in the work shall be thoroughly repaired in a manner satisfactory to the Engineer. When the concrete work has attained sufficient strength, the Contractor shall fill each basin or tank, or each compartment, with water and shall repair any imperfections which cause the water level to fall more than one-half inch in 24 hours. All noticeable leaks in any portion of the work shall be repaired in any case, even if the preceding requirements as to watertightness are satisfied.

It is expected that, with the proper precautions, a dense watertight concrete will be obtained. If a concrete which passes the above requirements for watertightness has not been obtained, the Contractor shall, under the direction of the Engineer, furnish all materials and do all work necessary to produce a watertight concrete. Materials and methods shall be subject to the approval of the Engineer. All treatment of concrete necessary to fulfill these requirements for watertightness shall be done at the Contractor's own expense.

16. Defective Concrete

Concrete shall be so placed, compacted, finished and cured so as to form a dense, compact, impervious artificial stone with smooth exposed faces. Any part of the work found to be honeycombed, porous, or otherwise defective in the opinion of the Engineer shall be removed or replaced, in whole or in part, at the expense of the Contractor.

17. Testing of Concrete

In general, Section 2 of these Specifications, entitled "Testing and Control of Materials" governs all testing.

The following tests and/or samples shall be taken in the field as work progresses:

a. Standard Slump Tests

Field slump tests shall be made by the Contractor, using an accurately made sheet iron test cone, in accordance with the provision of ASTM Specification C-143-74. At least one slump test shall be made for each pour, but the Engineer may require additional tests if it deems it necessary to insure the desired consistency of the concrete.

b. Concrete Compression Samples

(1) During the progress of the work and for each different mix of concrete, test cylinders shall be made from each day's pour with a minimum of one for each 25 cubic yards or a maximum of one from each batch or ready-mix truck load. The maximum requirement will be imposed only when the Engineer deems necessary due to wide fluctuations in the concrete quality. A minimum of three cylinders will be required for each day's pour if the concrete is used in structures or otherwise in a loadcarrying capacity. Sidewalks, manholes, etc., may require only one cylinder if poured less than 25 cubic yards per day and the quality remains sufficiently high, in the opinion of the Engineer.

Each cylinder shall be numbered and logged so as to adequately identify the representative concrete in the structure.

The following "break" schedule for cylinders from the same pour will be used:

Where only one cylinder is made	28 days
Where two cylinders are made	one at 7 days one at 28 days
Where three cylinders are made	one at 7 days one at 14 days one at 28 days
Where four cylinders are made	one at 7 days one at 14 days one at 28 days one reserved
Where over four cylinders are made	same as four plus reserve or as directed

(2) ASTM C-31-69 shall govern with curing as required. The testing shall be done per ASTM C-39-72.

18. Reinforcing Steel

a. General

Bar reinforcement and wire mesh reinforcement shall be furnished by domestic steel mills and tested in accordance with Section 2, "Testing and Control of Materials". Certified mill test reports shall also be furnished together with an affidavit indicating the origin.

b. Bar Reinforcement

Reinforcing steel shall conform to the requirements of ASTM Standard Specifications A-615-68, latest revision; new billet steel, Grade 60, with deformations conforming with ASTM A-615-68, latest revision. An affidavit showing the heat numbers and origin shall be furnished.

All bars shall be lapped a minimum of 30 diameters at splices unless a greater lap is shown on the Plans.

All detailing, fabrication and erection of reinforcing bars, unless otherwise noted, shall be in accordance with the ACI "Manual of Standard Practice for Detailing Reinforced Concrete Structures" (ACI 315-65), latest revision.

The Contractor shall furnish the Engineer with five copies of shop drawings of reinforcing bars and schedules showing all bends and special bars. These shop drawings and schedules must have the approval of the Engineer before shipment is made. The bars shall bear a designation on the drawings and in the schedule and shall be tagged with metal tags for identification. The Engineer's representative shall be afforded free access to the fabricating shops.

c. Wire Mesh Reinforcement

Wire mesh reinforcement shall conform to the requirements of ASTM Designation A-185-70, latest revision.

d. Openings

Openings 12 inches and larger through concrete walls and slabs shall have a minimum of four extra diagonal bars in each face of the wall or slab of the same size as the largest bar in the wall or slab. The length of extra diagonal bars at openings shall engage a minimum of 40 bar diameters each side of the opening unless space requires full bond to be developed by means of hooks.

e. Minimum Reinforcing Steel

Class "A" concrete walls, slabs and other concrete work shown on the Plans to have no reinforcing, shall have a minimum area of steel reinforcing equal to 0.0025 times the cross-sectional area of the concrete work.

f. Storage and Protection

Steel reinforcement, either bars or mesh, shall be new stock free from rust scale and shall be stored above the surface of the ground upon platforms, skids or other supports and protected from the weather. When placed in the work, it shall be free from rust, dirt, scale, paint, oil or other foreign matter which may reduce or destroy bond. A thin coating of red rust resulting from short exposures will not be considered objectionable when bars are placed in the work, but any bars having rust scale or a thick rust coat shall be thoroughly cleaned to the satisfaction of the Engineer, or shall be rejected and removed from the premises if ordered by the Engineer.

g. Placing and Fastening of Reinforcement and Inspection Thereof

Steel reinforcement shall be placed in the exact position as shown on the Plans and held securely in place during the placing of the concrete. All reinforcement shall be wired together at intersections or as directed by the Engineer. Sheet metal or welded wire bar spacers shall be used for bars in all steps, walls and beams. Hychair, or approved equal, shall be provided for the support of reinforcement of slabs and flat surfaces. When the reinforcement is placed in the work, it shall have a clean, fresh surface, free from dirt, scaly rust, mill scale, paint, oil or other foreign substances.

Before any concrete is placed, the Engineer shall have inspected the placing of the steel reinforcement and given permission to deposit the concrete. Concrete placed in violation of this provision may be rejected and thereupon shall be removed.

* * *

SECTION 4

SITE PREPARATION AND DEVELOPMENT

1. Scope

The work covered by this Section consists of furnishing all materials and equipment and performing all labor necessary for site prepraration and development which includes but is not limited to clearing, excavating, construction of sludge landfarm and access roads, construction of embankments, construction of drainage systems, landfarm sump, installation of oil-water separator system, backfilling, grading, fencing and grassing, and all incidentals as shown on the Plans.

The site development work specified under this Section of these Specifications shall be performed in such a chronological order as to leave the site in the best possible finished condition. The order of this work is subject to the Engineer's approval, but such approval shall in no way relieve the Contractor of any responsibilities for repair of work damaged by its acts or acts of God.

2. Site Conditions

The Contractor affirms by the submission of its bid that it has examined the location of the work and has informed itself fully as to the site conditions, the configuration of the ground, the character, quality and quantity of the materials to be encountered, the equipment and facilities needed preliminary to and during the prosecution of the work, the general and local conditions, and all other matters which can in any way affect the work to be done.

3. Clearing and Grubbing

The site shall be cleared and grubbed of all obstructions interfering with the construction of new work.

The Contractor shall strip the entire area within cut, fill and graded areas to remove all topsoil, trees, vegetable matter, stumps, roots, down timber, brush and other objectionable materials standing or protruding from the ground. Topsoil and vegetable matter shall be carefully stockpiled and preserved for reuse. Roots and stumps shall be grubbed out to a minimum of 18 inches below the surface of the ground and burned or removed from the property entirely. Holes caused by grubbing and stripping operations shall be filled to the level of adjacent ground. The base of all embankments and fills shall be scarified and rolled so that the base will be well bonded with the first layers of fill. In the event that the topsoil available is not adequate to cover the area that is scheduled to be seeded upon completion of construction, the Contractor shall, at its own expense, supply enough additional topsoil to insure at least four inches of topsoil in all areas to be seeded.

All material and debris resulting from clearing and grubbing operations shall be burned or otherwise disposed of by the Contractor in a manner approved by the Engineer. It shall be the responsibility of the Contractor to obtain permits for burning in areas where such permits are required and it shall be responsible for any and all damage to surrounding property or areas caused by its burning operations.

4. Excavation

a. General

The Contractor shall perform all excavating of every description and of whatever substance encountered, to the dimensions and levels shown on the Plans and/or specified. Excavation shall be unclassified regardless of material excavated. Excavation may be accomplished by any customary method, unless otherwise specified.

The Contractor shall locate existing utilities by hand excavation and provide protection from damage; cooperate with Owner and utility companies for maintaining services; refrain from breaking utility connections without providing temporary services acceptable to the Engineer; and repair damage to existing utilities as directed by utility companies, Owner or Engineer.

The Contractor shall protect structures, utilities, sidewalks, pavements and other facilities in areas of work. Barricade open excavations and provide warning lights. Comply with governing safety regulations.

Provide bracing and shoring as required in excavations, to maintain sides and to protect adjacent structures from settlement, complying with local codes and regulations. Maintain until excavations are backfilled.

The Contractor shall remove and dispose of material encountered to obtain required subgrade elevations, including pavement, obstructions visible on ground surface, underground structures and utilities indicated to be removed. Stockpile suitable excavated materials where directed until required for backfill and fill. Transport acceptable excess excavated material to designated soil storage areas on the site, stockpile or spread as directed. Remove and dispose of unacceptable excavated material, trash and debris from the site.

b. Rock

Rock excavation shall be defined as solid rock in the original bed or in well defined ledges, the removal of which, in the opinion of the Engineer, requires drilling, blasting or the use of jack hammers and bull points, and shall also include all bounders and detached pieces of rock containing twelve cubic feet or more. All loose, weathered or disintegrated rock unsuitable for foundations shall be excavated to solid rock. Special care shall be taken during blasting and excavating so as not to disturb any rock on which foundations are to be placed. Before placing concrete foundations on rock surfaces, the surface shall be thoroughly cleaned and inspected by the Engineer.

c. Blasting

All blasting operations shall be conducted in accordance with existing ordinances and regulations and shall be done subject to the Engineer's approval of the method and quantity of explosive to be used. The approval of the Engineer will be tacit and shall in no way relieve the Contractor of complete responsibility. The Contractor shall maintain a current log of its blasting operations including therein the amount of the explosive used, the time of detonation and the location involved. Exposed structures shall be protected from the effects of blasts and blasts shall be covered with suitable mats and shall be restricted to the extent that no appreciable shock will be transmitted to existing structures, pipe-lines or other public or private facilities. All blasting supplies shall be stored in accordance with existing ordinances and laws.

d. Limits

Excavations shall be made for a sufficient distance outside foundation walls to allow for inspection and to permit the various trades to install their work.

Excavations for walls shall be carried a minimum of two feet outside the wall. Excavation for piers shall be at least two feet greater than the dimensions of the piers. Excavation for footings shall be to the footing dimensions.

If unsatisfactory soil materials are encountered at design elevations, continue excavation as directed by the Engineer. If conditions are not a result of Contractor's negligence, additional excavation will be measured as directed by the Engineer and paid for in accordance with contract conditions relative to changes in the work.

e. Depth

Care shall be taken that excavation does not extend below the exact lines of the subfoundations, footings and floor slabs on earth or rock. Should the excavation, through carelessness or negligence on the part of the Contractor be carried below such lines, the Contractor shall fill in the resulting excess excavation with Class "C" concrete and/or compacted crushed stone as directed by the Engineer. This work shall be done at the Contractor's expense.

f. Dewatering

The Contractor shall by the use of well points, pumps or other approved methods, prevent the accumulation of water in excavated areas. Should water accumulate, it shall be promptly removed. The Contractor shall also provide for dewatering areas adjacent to structures to prevent uplift during construction and startup operations.

The Contractor will be held responsible for any damage due to uplift of such structures or pipelines during construction operations.

g. Unsuitable Material

Where muck, rock, organic matter or other material within the limits of construction is, in the opinion of the Engineer, unsuitable in its original position, the Contractor shall excavate such material and backfill the excavated area with suitable material approved by the Engineer which shall be compacted and shaped to conform to the required section.

5. Embankments and Backfilling Around and Under Structures (and Pipelines)

a. General

All embankments and backfills around structures and pipelines shall be of selected materials properly placed in layers to required elevations and limits shown on the Plans. Use suitable material, approved by the Engineer, free of rock or gravel larger than two inches in any dimension, debris, vegetable matter, waste and frozen materials. Backfill excavations as promptly as work permits.

The Contractor shall prepare ground surface to receive fill by removing vegetation, debris, unsatisfactory soil materials and obstructions. Prior to placing any fill material, the surface shall be plowed, disked or scarified as required so that the fill material will bond with existing surface.

Place backfill and fill materials in layers not more than eight inches in loose depth, compacting each layer to required maximum density. Do not place materials on surfaces that are muddy, frozen or contain ice or frost. Each layer of the embankment or backfill shall be moistened and thoroughly compacted to a solid homogeneous mass having at least 95% of maximum theoretical density as determined by method A ASTM D-698. The compacted thickness of each layer shall not exceed six inches. Compaction of earth fills shall be accomplished by rolling with a sheep's foot roller until the roller "walks-out".

Compaction around structures and pipelines shall be by use of heavy power tamping equipment. Selected materials shall be used for backfill around pipe in pipe trenches.

The sheep's foot roller shall be of a self-cleaning type with feet projecting seven inches from the shell and of such weight that the load on each tamper foot with the drum empty will not be less than 100 pounds per square inch of area in contact with a plane surface. Rolling shall be carried on until the feet will have no appreciable imprint when the shell is a maximum weight.

Pneumatic tired rollers shall be suitable for ballast loading which will give a minimum compression under working conditions of 325 pounds per inch width of tire tread. Forward and rear tires shall make separate tracks. Compaction shall be equivalent to that required for the sheep's foot roller.

Sprinkle water on surface of subgrade or layers of soil material where soil is too dry to permit compaction to required density. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to required density.

The Engineer shall inspect all compacted areas prior to further construction operations to insure that satisfactory compaction has been obtained. Field density test shall be made in accordance with ASTM D1556, ASTM D2167, or ASTM D2922. When field tests show failure to meet density requirements, the soil shall be loosened by disking, harrowing or other approved methods to a depth of at least six inches, then reshaped, recompacted and retested.

b. Structures on Earth

Where structures rest on earth, all loam, organic or other undesirable material shall be removed as required by the Engineer. When filling is required to bring such excavated area to the levels required to receive structures, the fill shall be compacted by tamping and rolling to obtain 98% of maximum density as per ASTM D-698 Method A. Layers shall be not more than six inches thick.

c. Grading and Maintenance

Grade areas indicated, including adjacent transition areas, with uniform levels or slopes between finish elevations. Shape surface of areas to within 0.10' above or below required subgrade elevation, compacted as required.

The Contractor shall repair and re-establish grades in settled, eroded, rutted or otherwise damaged areas. In damaged compacted areas, scarify the surface, reshape and compact to required density prior to further construction.

d. Field Tests for Compaction

Field tests to verify compaction shall be performed by an independent testing laboratory selected and paid for by the Contractor and approved by the Engineer. As a minimum, one compaction test will be required for each vertical foot of fill per 10,000 square feet (or fraction thereof) of fill area.

e. Crushed Stone (Furnas Curve)

Where shown on the Plans or otherwise required under structures, the Contractor shall place and compact crushed stone in six inch or thinner layers. Materials shall meet the same requirements as those given for concrete except gradation. Gradation shall approximate a furnas maximum density curve which is as follows and shall be approved by the Engineer:

Screen	Percent Passing
1½	100
4	32-48
16	15-25
30	10-18
100	2- 8

6. Sludge Landfarm Basins and Embankments

a. General Description

The sludge landfarm facility is a three-celled basin constructed with earthened dikes. The outside and inside slopes of all dikes are 2:1.

Groundwater and surface water contamination from the contents of the sludge landfarm facility is prevented by a protective 12-inch thick impervious layer of clay covering the entire interior bottom area of the basin and extending to the top inside edge of the exterior dike. In addition, the clay extends up the interior edges of the common interior dike between Bays 1 and 2 to the elevations shown on the Plans.

A 12-inch layer of sand and a 24-inch minimum treatment zone layer overlay the impervious clay layer within each bay of the sludge landfarm. The top of each dike and the exposed slopes above the top of the treatment zone layer on the inside face and above existing grade on the exterior face of the dikes shall be protected from weathering by a crushed stone erosion belt.

In general, the requirements of all other applicable paragraphs of this Section of these Specifications shall apply to work required to prepare the site, excavate, install fills and embankments, finish grade and perform incidental work associated with the construction of the sludge landfarm.

b. Construction of Cut Slopes, Fills and Embankments

Clearing and grubbing, removal of topsoil and excavation for the sludge landfarm basin shall be in accordance with the requirements of Paragraphs 3 and 4 of this Section. Embankments and fill for the sludge landfarm shall be placed in accordance with Paragraph 5 of this Section of these Specifications.

Cut slopes and areas to be filled shall be disked and scarified to 12 inches deep in the in-place soil and compacted to 95% Proctor density before fill is placed. Any cuts in rock shall be carried at least 12 inches below finish grade and filled with earth material and compacted to finish grade or subgrade as described herein.

Materials for fill shall be selected from the excavated or cut areas for the sludge landfarm basin, borrow materials from a nearby location within the Owner's property, imported borrow materials from an approved offsite source, or a combination of these materials, as required. Any such borrow area will be cleared and stripped of topsoil prior to taking the borrow material, regraded to provide proper drainage and the topsoil replaced and reseeded. Fill material required from borrow areas shall be approved by the Engineer. The fill shall be placed to the dimensions and configuration as shown on the Plans.

The fill and embankment for the sludge landfarm basins shall be placed in layers and thoroughly compacted to a solid homogeneous mass having at least 95% of maximum theoretical density as determined by Method A of the current issue of ASTM D-698. The compacted thickness of each layer shall not exceed ten inches unless otherwise directed by the Engineer.

During construction of the fill and embankment, field compaction tests for the in-place fill material shall be made by an independent testing laboratory. The independent laboratory shall be selected by the Contractor, subject to the Owner's approval, and costs of testing shall be paid by the Contractor. As a minimum, one test shall be made for every 20,000 square feet of fill area for every one foot lift in the landfarm bottom area. Along the dike, a compaction test shall be made every 200 feet for every one foot vertical lift. Field density test shall be made in accordance with ASTM D1556 or ASTM D2167. When field tests show failure to meet density requirements, the soil shall be loosened by disking, harrowing, or other approved methods to a depth of at least six inches, then reshaped, recompacted and retested. The top of every lift shall be scarified at least two inches deep to allow the next layer to bond.

Soil tests shall be made on representative samples from the landfarm area and any borrow area before excavation is started in accordance with ASTM D-698-78, Method A, to determine maximum density and optimum moisture of the soils to be used in the landfarm construction. Soil tests locations will be determined by the Owner or Engineer. Soil tests will be conducted by an independent testing laboratory approved by the Engineer and all tests will be paid for by the Contractor.

c. Clay

The clay for the impervious liner shall be imported from an off-site source. The clay source shall be approved by the Owner and the Engineer. It shall be compacted in accordance with the requirements specified above for fill to an extent that it provides an impervious layer with a permeability of no greater than 10^{-7} cm/sec.

d. Sand and Treatment Zone Material

The sand shall be clean, native sand approved by the Engineer. The treatment zone material shall be native soil from an approved borrow area. Each material shall be highly permeable, clean and free from trash, roots or other objectionable foreign material.

e. Crushed Stone Erosion Belt

To protect the slopes of the landfarm basin, a belt of crushed stone shall be placed along the top of each exterior dike, on all interior slopes from an elevation 12 inches below the top of the treatment zone layer to the top inside edge of each dike and on the exterior slopes from existing grade to the top outside edge of the dike. A belt of crushed stone shall also be placed along the top of the two interior dikes and on the interior slopes of each dike to an elevation 12 inches below the top of the treatment zone layer. The crushed stone shall be AASHTO M-43, Size No. 1, Course Aggregate Fill and shall be placed to a depth of at least six inches.

7. Borrow Material

The Owner will attempt to provide areas within the refinery property for obtaining adequate fill materials. If additional borrow materials are required, the Contractor must make arrangements to obtain and transport borrow materials. Borrow materials shall be subject to the approval of the Engineer. As a minimum, two soil borings shall be made at the proposed borrow pit site and the Atterburg limits and Proctor density determined. The testing laboratory shall be selected and paid by the Contractor subject to the Engineer's approval.

8. Drainage Pipes and Appurtenances

a. General

Drainage pipes and appurtenances shall be constructed as shown on the Plans and specified herein. All drainage pipes shall be installed with the required slope in the proper direction for gravity drainage.

Generally, all storm drainage pipes crossing under roadways and dikes shall be of the materials shown on the Plans with headwalls or manholes at both ends. Substitute material will be allowed only if approved in advance by the Engineer and the substitute material provides equal or greater strength.

The underdrain pipe installed within the sand layer of the sludge landfarm basin shall be either rigid perforated PVC pipe or perforated vitrified clay pipe. Piping carrying drainage from the underdrain system to sludge landfarm drainage sump shall be solid PVC pipe.

b. Pipe Materials

(1) Reinforced Concrete Pipe

All concrete drainage pipe 12 inches and larger shall be reinforced concrete pipe. Reinforced concrete pipe shall meet requirements of ASTM Standard C-76, latest revision. More specifically, all 12-inch and 15-inch pipe shall meet the requirements for Class IV, "B" Wall as per ASTM C-76-77 and all 18-inch and larger pipe shall meet the requirements for Class III, "B" wall per ASTM C-76-77.

Pipe shall be either centrifugally cast, vibrated horizontally cast or vibrated vertically cast. The concrete used in the manufacture of the pipe shall attain a minimum compressive strength of 6,000 pounds per square inch at 28 days. Absorption shall not exceed 4.5 percent.

Steel reinforcement shall consist of either cold drawn wire, ASTM Designation A-82; welded wire fabric, ASTM Designation A-185; or hot rolled bars, intermediate grade, ASTM Designation A-15.

Pipe shall be cast in lengths of eight or twelve feet. Joints shall be of the bell and spigot type utilizing a single round rubber gasket and conforming to AWWA C-302 joint specifications.

(2) Non-Reinforced Concrete Pipe

All concrete pipe ten inches or smaller in size shall be non-reinforced pipe. Non-reinforced concrete pipe and fittings shall be of the bell and spigot type and shall conform to ASTM Specification C-14-77. Joints shall be of the rubber gasket type and meet ASTM Specification C-433.

Non-reinforced concrete pipe shall meet the physical and dimensional requirements for Class 3 Concrete Pipe in Table 1 of ASTM Specification C-14-77. The concrete used in the manufacture of the pipe shall attain a minimum compressive strength of 4,000 pounds per square inch at twenty-eight days.

After its manufacture the pipe shall be cured by a method described in ASTM C-14-70 for a sufficient length of time to insure the specified compressive strength. All pipe shall be aged on the producer's yard for at least fourteen days prior to shipment to the job site.

(3) Ductile Iron Pipe

Ductile iron pipe shall be centrifugally cast, manufactured and tested in accordance with the requirements of ANSI Specifications A21.51 and AWWA C151. Thickness class of pipe shall be Class 52 unless otherwise noted or approved by the Engineer. All ductile iron pipe and fittings shall be furnished tar coated inside and outside. Pipe shall be nominal 16', 18' or 20' lengths.

Joints and fittings shall be flanged, bell and spigot or mechanical joint as shown on the Plans or as otherwise required for the function performed. Ductile iron fittings shall meet the requirements of ANSI Specification A21.10 and A21.11, as applicable.

(4) Corrugated Metal Pipe

Corrugated metal pipe shall be fabricated using not less than two ounces per square foot of galvanize with a layer of asbestos fibers firmly embedded in the zinc and covered with a bituminous compound. The corrosion resistant coating of zinc, asbestos fibers and bituminous material shall be applied to the inside and outside of the pipe. The corrugated metal pipe shall be 14 gauge unless otherwise shown on the Plans, and shall be of the diameter shown on the Plans.

Field joints for corrugated metal pipe shall be made with fabricated 14 gauge watertight asbestos bonded, galvanized metal coupling bands and gaskets which mesh into the bands. Bands and gaskets shall each be at least three corrugations wide. The gasket shall be made of 3/8-inch thick closed cell, synthetic sponge rubber, fabricated in the form of a cylinder with a diameter approximately ten percent less than the nominal pipe size. Gaskets and coupling bands shall be installed in accordance with the manufacturer's directions. A field coat of the same type of bituminous material used for shop coating the pipe shall be applied to the joint to protect it from corrosion after the jointing is completed. The ends of the pipe where applicable shall be the skewed type to fit the headwalls. All burrs, etc., at headwall ends shall be ground smooth.

(5) Polyvinyl Chloride (PVC) Drain Pipe

Polyvinyl chloride drain pipe and fittings shall meet or exceed all of the requirements of ASTM D-2665. All pipe shall be Schedule 40 minimum unless otherwise shown or approved by the Engineer. Pipe shall be furnished in either ten or twenty foot lengths.

All PVC pipe shall be stored at the project site in strict accordance with the manufacturer's recommendations and at all times prior to actual installation of the pipe, the Contractor shall be responsible for providing uniform support for each length of pipe stored at the site. PVC pipe that has been bowed by the sun shall not be laid until it has straightened and lies without restraint.

(6) Soil Pipe

Cast iron soil pipe and fittings shall conform to Federal Specifications WW-P-401-D, commercial extra heavy grade with bituminous coating. Joints shall be leaded in accordance with best plumbing practice or may be rubber compression joints.

(7) Perforated Underdrain Pipe

Polyvinyl chloride underdrain pipe shall meet or exceed the requirements of ASTM D-2665 or ASTM D3034 as applicable. Wall thickness shall be suitable for earth loads intended.

Vitrified clay underdrain pipe shall be extra strength conforming to the requirements of ASTM C-700 with joints conforming to ASTM C425.

Underdrain piping shall have four rows of 1/4-inch diameter holes located in the bottom half of the pipe. The holes of each row shall be spaced at approximately four inches on center.

A suitable permeable fabric wrap shall be placed around the perforated underdrain pipe and the crushed stone envelope as shown on the Plans to prevent the sand and other fines from plugging up the perforations.

c. Installation of Pipelines

(1) Excavation for Pipelines

Unless otherwise directed by the Engineer, trenches shall be excavated in open cut to the depths shown on the Plans. Trenches shall be of sufficient width to provide free working space on each side of the pipe but, unless specifically authorized by the Engineer, trenches shall in no case be excavated or permitted to become wider than one foot six inches plus the nominal diameter of the pipe at the level of the crown on the pipe.

Before laying the pipe, the Contractor shall open the trench far enough ahead to reveal obstructions that may necessitate changing the line or grade of the pipeline. The trench shall be straight and uniform so as to permit laying pipe to lines and grades as shown on the Plans.

Whenever the excavation is carried beyond or below the lines and grades given by the Engineer, the Contractor, at its own expense, shall refill such excavated space with such material and in such a manner as will insure stability of the structure or line involved, including the use of crushed stone or Class "C" concrete.

Overbreakage is that portion of any material displaced or loosened beyond the finished work as planned or authorized by the Engineer, including slides. All overbreakage shall be removed by the Contractor and disposed of as directed. Payment will not be made for removal and disposal of breakage.

(2) Shoring, Sheeting, Bracing and Dewatering

Dewatering shall be in accordance with Paragraph 4 of this Section of these Specifications.

Where unstable material is encountered, or where necessary to comply with ordinances or statutes, or Federal Regulations, or where the depth of excavation exceeds ten feet, the sides of the trench or excavation shall be supported by substantial sheeting, bracing and shoring.

Adequate and proper shoring of all excavations shall be the entire responsibility of the Contractor.

Foundations which may be affected by the excavations shall be supported by shoring, bracing or underpinning of a temporary or a permanent nature as may be required to assure the integrity of the structure. The Contractor shall be held entirely responsible for any damage to said foundation.

Solid sheeting will be required for wet or unstable material. It shall consist of continuous vertical sheet piling of timber two inches thick or steel with suitable shores and braces. All sheeting to be left in place shall be two-inch timber.

Care shall be taken to avoid excessive backfill loads on the completed pipelines. The requirement that the width of the ditch at the level of the crown of the pipe be not more than one foot six inches plus the nominal diameter of the pipe shall be strictly observed.

Trench sheeting shall not be removed until sufficient backfill has been placed to protect the pipe.

All sheeting, planking, timbering bracing and bridging shall be placed, renewed and maintained as long as is necessary. Unless directed by the Engineer, any sheeting left in place is not a separate pay item.

(3) Pipe Bedding

All pipe shall be laid in a bed of crusher-run stone or chert meeting the requirements of the ASTM D2321-74, Class I. In general, as shown by the laying details on the Plans, the trench shall be opened below the bottom of the pipe and refilled with the bedding materials to a depth sufficient to provide a firm bed for the bottom quadrant of the pipe at the proper line and grade. Care shall be taken to insure that the bedding material has been worked under the pipe and on each side to provide adequate side support. Bell holes shall be dug at each joint to prevent bridging.

When rock is encountered, the trench shall be excavated to a depth of at least six inches below the invert of the pipe and refilled with the bedding material to a sufficient depth to provide a firm bed for the bottom quadrant of the pipe.

If unsuitable material is encountered in the trench bottom, the Engineer may require additional excavation to insure a firm foundation for the pipe. In such cases, the trench bottom shall be brought back up to proper grade with bedding material as provided hereinbefore.

(4) Laying Pipe

The trench shall be excavated to the required depth and width, and bell holes dug in the bedding in advance of pipe laying.

The laying of drainage pipe in finished trenches shall be commenced at the lowest point, so that the spigot ends point in the direction of the flow. All pipes shall be laid with ends abutting and true to line and grade as indicated on the Plans or as directed by the Engineer. They shall be fitted and matched so that when laid in the work they will form a drainage pipe with a smooth and uniform invert. Supporting of pipes shall be as specified under Subparagraph (3), "Pipe Bedding" and in no case shall the support of pipes on blocks or earth mounds be permitted.

Branches, fittings and specials for drain lines shall be provided and laid as and where directed by the Engineer or shown on the Plans. All open ends of the pipe and of the branches shall be sealed with stoppers or bulkheads firmly held in place in a manner acceptable to the Engineer.

Open ends of unfinished pipelines shall be securely plugged or closed at the end of each day's work or when the line is left temporarily at any other time.

(5) Backfilling Pipeline Trenches

In backfilling all pipelines, crushed stone or chert conforming to ASTM D2321, Class I, shall be placed around the pipe up to a plane six inches above the top of the pipe. Little or no compaction of the Class I material is required, but care shall be taken to insure that the bedding material has been worked under the haunch of the pipe on each side to provide adequate side support.

Walking or working on the complete pipeline, except as may be necessary in tamping or backfilling, shall not be permitted until the trench has been backfilled to a height of at least six inches above the top of the pipe with Class I material. The filling of the trench shall be carried on simultaneously on both sides of the pipe in such a manner that the completed pipeline will not be disturbed and injurious side pressures do not occur. Backfilling of the remainder of the trench shall be in accordance with the requirements of Paragraph 5 of this Section of these Specifications.

d. Appurtenances

(1) Flap Valves

Flap valves shall be furnished for the mounting conditions as shown on the Plans and shall be of the single hinged type bronze mounted with bronze seat rings in both the flange and flap and bronze hinge pins. Valves shall be Chapman, M&H, Mueller or approved equal.

(2) Gate Valves

Gate valves shall conform to the requirements of AWWA C500 and shall be suitable for working pressures up to 200 psi. Gate valves shall be furnished with connections as shown on the Plans and shall be opened by turning to the left. Gate valves shall be tested at double its working pressure. Valves shall be coated with black asphalt varnish. Cast iron valve boxes with lids shall be furnished and installed with each gate valve.

(3) Aluminum Slide Gates

The aluminum slide gates and frames shall be of the type and alloy recommended by the manufacturer for the purpose intended and shall be constructed as shown on the Plans.

Any surface of aluminum that comes into contact with masonry materials, concrete or dissimilar metals shall be protected by a coating of heavy bodied bitumastic paint or a layer of neoprene insulating material as required by the Engineer. All aluminum shall be protected with vaseline or petroleum jelly after installation and during the remainder of construction work. The protective coating shall be cleaned off prior to final acceptance.

9. Manholes and Oil Sump

a. General

Manholes and the oil sump of the form and dimensions shown on the Plans shall be built as directed. The manholes shall be constructed of precast concrete rings with a precast concrete base and shall be provided with cast iron frames and covers. The oil sump shall be constructed of precast concrete rings on a concrete foundation and shall have a concrete top slab with access hatch as shown on the Plans.

All manholes and the oil sump are to be furnished and installed to provide a completely watertight structure. No structure shall be considered complete and acceptable until all leakage is eliminated.

b. Precast Concrete Rings

Precast concrete rings shall be constructed using standard forms and shall conform to ASTM Standard Specification C478-77 except that:

1) Two layers of reinforcing steel shall be as required for a Class II "A" wall by ASTM C76-77;

2) Permissible variations shall be as required by ASTM C76-77;

3) The concrete mixture shall contain no less than 846 pounds per cubic yard (9.0 bag mix) of Portland cement.

No holes for lifting will be allowed. The precast rings shall be jointed using a confined O-ring gasket joint. The joint shall be grouted smooth on the inside and outside of the precast concrete rings so that no crack is visible.

The outside surface of the manholes and the oil sump shall be coated with two layers of bitumastic coating applied at right angles to each other.

c. Manhole Inverts

Manhole inverts shall be formed from Class "C" concrete as shown on the Plans. Inverts for a "straight-through" manhole may be formed by laying the pipe straight through the manhole, pouring the concrete invert, and then breaking out the top half of the pipe. Curved inverts shall be constructed of concrete, as shown, and shall form a smooth, even half-pipe section, as shown.

d. Manhole Steps

Manhole steps shall be Alcoa Standard Design #10243 weighing 2.2 pounds, Clow Model F-3650 weighing 11 pounds, John Bouchard #1880 weighing 12 pounds, or equal.

Aluminum manhole steps shall incorporate two non-skid grooves not to exceed 1/8" deep and 1/8" wide and shall be made of aluminum alloy conforming to Federal Specification QQ-A-200/8D having a minimum tensile strength of 38,000 psi and a minimum yield strength of 35,000 psi. Each step must be capable of carrying a load of 1,000 pounds in the center of the cross bar when projected six inches from the wall.

Iron manhole steps shall be made of the highest grade wrought iron or cast iron, resistant to rust and corrosion. After being set, they shall be given two coats of high quality black asphaltum varnish. Wrought iron or cast iron steps shall meet the latest ASTM Specifications and have a minimum tensile strength of 35,000 psi. Each step must be capable of carrying a load of 1,000 pounds in the center of the cross bar when projected six inches from the wall.

e. Manhole Frames and Covers

Manhole frames and covers shall be furnished and thoroughly grouted in place with cement mortar. The frame and cover shall be of the type and dimensions shown on the Plans and shall weigh no less than 350 pounds (Nennah R-1642, or approved equal).

f. Manhole-to-Pipe Joints

Manhole-to-pipe joints shall be made watertight by the use of special gaskets, waterproof grouts, or other methods as detailed on the Plans or approved by the Engineer.

10. Water Lines and Appurtenances (NOT APPLICABLE THIS CONTRACT)

a. Water Lines

Water lines shall be PVC or galvanized steel pipe as directed by the Engineer. Installation of water lines shall conform to the requirements of Paragraph 8 of this Section of these Specifications.

Galvanized steel pipe shall be standard weight galvanized nickel-copper alloy steel pipe conforming to ASTM Standard A-333 Grade 9 with tensile strength of 60,000 psi and yield strength of 46,000 psi.

Steel pipe shall have screwed joints and fittings shall be galvanized, malleable iron conforming to Federal Specifications WW-P-521F, except that nipples and couplings shall be of the same materials as the pipe.

PVC pipe shall be Schedule 80 conforming to the requirements of ASTM D-1785 and D-2464 suitable for working pressures up to 200 psi.

Water lines shall be flushed, pressure tested and sterilized in accordance with local Health Department regulations prior to placing lines into service.

b. Gate Valves

Gate valves shall conform to the requirements of AWWA C500 and shall be suitable for working pressures up to 200 psi. Gate valves shall be furnished with connections as shown on the Plans and shall be opened by turning to the left. Gate valves shall be tested at double its working pressure. Valves shall be coated with black asphalt varnish. Cast iron valve boxes with lids marked "Water" shall be furnished and installed with each gate valve.

c. Yard Hydrant

Yard hydrants shall be genuine "Murdock" compression type, Clow #F-4710, Murdock M-100 or equal for 2.5 feet of bury with one-inch inlet and threaded outlet for hose connection. All yard hydrants shall have a hose rack located conveniently. Seventy-five feet of hose with suitable nozzle shall be furnished for each hydrant.

11. Concrete Anchors, Cradles, Collars, Headwalls and Encasement

Concrete for anchors, cradles and encasement shall be Class "C". Non-reinforced collars shall be Class "C" concrete; reinforced concrete collars or headwalls shall be Class "A" concrete.

Anchors shall be poured against firm, undisturbed earth or rock as shown on the Plans. The dimensions shown on the Plans are the minimum allowable.

Cradles shall be of the sizes shown on the Plans. Pipeline to be encased in concrete shall be placed on six-inch concrete blocks positioned behind each pipe bell. After jointing the pipe, it shall be brought to the established grade by driving wooden wedges between the pipe and the concrete block. After the pipe has been brought to grade and is firmly affixed in place for true alignment, the pipe trench shall be backfilled with Class "C" concrete to the spring line of the pipe. Backfilling will then cease until the concrete shall attain its "initial set". The remainder of the pipe trench shall then be backfilled with Class "C" concrete to a point above the pipe as shown on the Plans or as directed. After 24 hours, the backfill will then be made as specified herein.

Reinforced concrete collars where shown for connecting cast iron pipe to clay or concrete pipe shall be constructed of Class "A" concrete.

All storm drainage pipe shall have a reinforced concrete headwall at each end unless otherwise shown.

12. Disposition of Excavated or Waste Material

Excess excavated material shall be disposed of as shown on the Plans or as directed by the Engineer. All excavated material not needed for backfilling purposes shall be hauled away unless an area for disposal is indicated.

All materials resulting from clearing operations shall be burned or otherwise disposed of in a satisfactory manner. Materials to be burned shall be neatly piled and, when in a suitable condition, shall be completely burned. Precautions shall be taken to avoid damage to remaining trees and/or adjacent property. Compliance with air pollution statutes or ordinances will be the responsibility of the Contractor.

13. Finish Grading and Topsoiling

Finish grading shall be performed in accordance with the finished elevations and grades shown on the Plans and shall be made to blend into conformation with remaining natural ground surfaces. All finished grading surfaces shall be left smooth and free to drain. The tops of all cuts shall have berm ditches. Selected materials, which have been obtained from stripping the site, shall be spread upon the slopes of fills and all other areas inside the fence to a uniform depth and compacted. Excess materials should be spread and compacted as directed. The top four to six inches of material in areas to be grassed shall be topsoil. All stone chips, gravel, etc., shall be removed by raking or by hand so that lawn mowing will be safe and practical. The Contractor shall import topsoil if there is not a sufficient amount on the site.

14. Seeding, Sodding and Landscaping

All graded areas inside the fence (excluding the crushed stone areas, structures and bottom of landfarm bays) and as shown on the Plans shall be left smooth and thickly sown with a mixture of Blue Grass, Italian Rye Grass, Kentucky Fescue #31 and/or such other grasses as are specified by the Engineer. When the final grading has been completed, the entire area to be seeded shall be fertilized with ammonium nitrate at the rate of five pounds per 1,000 square feet. The analysis of the commercial fertilizer shall be determined by soil tests. After the fertilizer has been distributed, the Contractor shall disc or harrow the ground to thoroughly work the fertilizer into the soil. The seed shall then be sowed in two operations, broadcast either by hand or by approved sowing equipment. The application shall be thirty pounds per acre for each operation. If the Engineer determines to use "hulled" or "unhulled" Bermuda, the application rate shall be seven pounds per acre. After the seed has been distributed, the Contractor shall then lightly cover the seed by use of a drag or other approved device. All seed shall be covered with straw at the rate of 1½ tons per acre.

To insure a good grass cover and to minimize erosion on slopes, an erosion control fabric mat shall be installed on all slopes 3:1 or steeper. Erosion control mats shall be Enkamat, Hold Gro, or equal.

Any necessary reseeding or repairing shall be accomplished by the Contractor prior to final acceptance. If the construction work is brought to completion when, in the opinion of the Engineer, the season is not favorable for the seeding of the grounds, the Contractor shall delay this item of the work until the proper season for such seeding as directed by the Engineer.

Where sodding is required by the Engineer, sod shall be Bermuda or other approved type reasonably free of weeds and approved by the Engineer, carefully cut, transported and laid. Sod shall be so laid that no voids occur between strips. Weed roots shall be removed as the sod is laid. Sod shall be tamped or rolled immediately after it is laid, and the finished surface shall be true to grade, even and equally firm at all points. Well screened topsoil shall be lightly sprinkled over the sodded areas, and shall be raked to insure sealing the sod joints.

All planting and seeding shall be watered thoroughly as soon as completed and shall be watered twice daily or more often if necessary, to provide continuous growth without setback until all growth is thoroughly established.

15. Fencing

The Contractor shall provide a complete protection type fence as shown on the Plans. The fence shall be six feet high overall (six feet fabric height), consisting of two inch mesh x nine inch gauge x 72" copper bearing steel wire fabric galvanized after weaving as per ASTM A-392-66 Class I. No barbed wire will be required along the top of the fence. Line posts shall be 2½" O.D. (2.92 pounds per foot) galvanized steel pipe. End, corner and gate posts for gates four feet or smaller shall be 3" O.D.(5.79 lbs. per foot). For gates eight feet and larger, posts shall be 4" O.D. (9.11 pounds per foot) galvanized steel pipe. Top rail shall be 1-5/8" O.D. (1.82 pounds per foot) galvanized steel pipe with extra long pressed steel sleeves. Terminal, corner and gate posts shall have the necessary strut and tie bracing. Double gates shall be equipped with heavy duty latches, gate stops and holders, and each gate shall have a heavy duty hardened bronze padlock with duplicate master keys. Posts shall be set at not more than ten feet apart and full three feet deep in concrete footings poured the full size of holes as excavated. Post holes shall be a minimum of six inches larger than the diameter of the post in earth and at least three inches larger than the diameter of the pipe in rock. Corner and gate posts shall be set 3'6" deep. Gate frames shall be of 2" O.D. (2.72 pounds per foot) steel pipe with welded corners with 1-5/8" internal bracing galvanized after welding. All galvanized steel pipe and specials shall meet or exceed the requirements of ASTM A-123-65. Special provisions shall be taken to prevent the entrance of stock or children where the fence crosses ditches or other areas which leave space. The Contractor shall submit five copies of shop drawings. The use of SS-40 galvanized pipe shall be allowed for all posts, rails and struts for all sizes up to and including three inch diameter.

16. Roadways

The roadways shall be constructed in accordance with the details and to the limits shown on the Plans and shall be properly crowned or sloped to drain.

The crushed stone roads shall be constructed over a properly graded and compacted subgrade. Fills and subgrade shall be compacted to 95% of maximum density per ASTM D-698, Method A.

The crushed stone shall be placed in layers as the construction of the facility progresses using crushed limestone or gravel complying with the requirements of Standard Specifications of the New Jersey DOT Bureau of Highways. The stone shall be placed in uniform layers not exceeding two inches per layer and compacted. The total compacted thickness of the crushed stone roadway shall be as shown on the Plans.

17. Final Cleanup

Before the work under the contract is considered complete, all rubbish and unused material due to or connected with the construction shall be removed and the premises left in a condition satisfactory to the Engineer. Streets, curbs, crosswalks, pavements, sidewalks, fences and other public and private property disturbed or damaged shall be restored to their former condition at the Contractor's expense. Final acceptance will be withheld until such work is completed.

18. Oil-Water Separator

The Contractor shall furnish and install a prefabricated oil-water separator and all appurtenant items including associated piping, concrete work, access hatches, oil sump, etc. as shown on the Plans and described herein or as required to provide a completely operable unit. The oil-water separator shall be a Model PGOWS-4000 prefabricated unit as manufactured by McTighe Industries, Inc. of Bohemia, New York, or approved equal. The oil-water separator shall be designed to accommodate a flow rate of 375 gallons per minute and remove oil particles and other lightweight materials and solids from oil-water mixtures down to 20 microns in size and produce an effluent quality of less than ten parts per million of oil.

The prefabricated unit shall consist of a carbon steel tank coated with an approved epoxy coating as recommended by the manufacturer. The tank shall be in conformance with Underwriters Laboratories, Inc. UL 58 (or ASME Code Section VIII, Division 1 for pressure vessels) and shall be suitable for underground installation. The tank shall have the basic overall dimensions of 5'-4" in diameter by 24 feet long with a total storage capacity of 4,000 gallons and a minimum wall thickness of 7 gauge. The prefabricated oil-water separator shall generally include, but not be limited to, the following items:

a. Inlet and Outlet Piping;

b. Distribution Chamber and Corrugated Plate Separator;

c. Corrugated Parallel Plate Separator;

d. Separating Chamber;

e. Petro-Pak Coalescing Separator;

f. Gravity Oil Draw-Off System;

g. Access Openings and Covers;

h. Sti-P3 Corrosion Protection System.

The incoming influent shall enter the oil-water separator at one end over a heavy corrugated plate set at a 33 degree angle. Sludge or heavy solids shall be collected at the center sludge baffle plate as they settle to the bottom of the separator. The influent shall then pass between an inclined arrangement of corrugated parallel plates, stacked upwardly, sloping at a 45 degree angle and spaced four inches apart.

The final phase of the oil separation process shall be as the influent passes through the Petro-Pak. The Petro-Pak shall consist of a polypropylene matrix of oil attracting fibers layered from coarse to fine and enclosed within a solid polypropylene framework. The effluent from the Petro-Pak shall then flow downward to the outlet where the clarified water is permitted to escape from the lower regions as the separated oil is withdrawn from the surface. A small area at the extreme bottom of the parallel corrugated plate shall be left open to allow sludge and heavy solids to pass through and collect at the center sludge baffle plate. An access opening above the baffle plate shall be furnished to permit periodic cleaning of solids from the tank and an access opening above the Petro-Pak shall be furnished to allow removal and cleaning of the Petro-Pak. The Gravity Oil Draw-Off System shall consist of two adjustable corrosion resistant skimmers which will allow oil to be skimmed from the tank and flow by gravity to the adjacent oil sump as shown on the Plans. Each skimmer shall consist of a slotted PVC unit which can be manually rotated with any adjustable wrench to remove floating oil at the desired level.

The corrosion control system shall be in strict accordance with Sti-P3 Specifications as applied by a licensee of the Steel Tank Institute. The Sti-P3 corrosion protection system shall basically consist of a tough, long-lasting coating applied to the entire surface of the tank, electrical isolation by using nylon reducing bushings or flange isolation kits, and a cathodic protection system utilizing sacrificial anodes. The size, number and placement of the anodes shall be as recommended by the manufacturer. The Sti-P3 corrosion control system should also include a 20 year limited warranty for leaks due to external corrosion. Tank shall bear UL (or ASME) and Sti-P3 labels.

The oil-water separator shall be installed underground in a high groundwater area. To prevent uplift, the oil water separator shall be strapped and anchored to a concrete pad below the unit as shown on the Plans. The tank shall be separated from the concrete slab by a minimum of at least six inches of sand or gravel. Anchors and straps shall be installed in such a manner as not to damage the protective coating of separator. The manufacturer will be responsible for sizing of the concrete pad and anchor straps to prevent uplift and shall submit recommendation to Engineer for approval prior to tank installation. Installation of the oil-water separator shall be performed in strict accordance with the manufacturer's recommendations.

19. <u>Landfarm Drainage Sump</u>

A landfarm drainage sump of the form and dimension shown on the Plans shall be built as directed. The landfarm sump shall basically consist of five eight-foot sections of 36-inch diameter, Class III, reinforced concrete pipe complying with the requirements of Paragraph 8.b(1) of this section of the Specifications. The ends of the concrete pipe sump shall be plugged or capped with precast plugs or caps incorporating a suitable butyl resin gasket, or equal, in order to provide a watertight structure. An an alternate, a Class "A" reinforced concrete cap can be poured in place as required to provide a watertight structure. The sump shall be tested for water tightness by any suitable and approved means prior to being placed into service.

To prevent uplift, the landfarm drainage sump shall be strapped and anchored to a concrete pad below the sump as shown on the Plans. The sump shall be separated from the concrete slab by a minimum of at least six inches of sand or gravel. Anchors and straps shall be installed as required to prevent uplift during the worst condition assuming the groundwater surface is above the top of the sump and the sump is empty.

The withdrawal pipe and vent shall be constructed of standard Schedule 40 steel pipe and fittings with screwed or flanged joints as required.

20. Concrete Pipe Ditch

The drainage ditch within the landfarm basin shall be constructed utilizing half sections of 15-inch concrete pipe. The pipe shall be furnished by the Owner and stockpiled at a suitable storage area near the landfarm facility. The Contractor shall be responsible for hauling and installing the concrete pipe ditch as required and as shown on the drawings. The transitions at the junction points of two ditches (Bay 1) and at bends shall be constructed with Class "A" concrete, reinforced with minimal welded wire fabric. The shape of the transitions shall be as required by the Engineer on the field to provide a smooth invert and a suitable cross sectional area for conveying the surface runoff.

* * *

SECTION 5

BASIS OF PAYMENT

1. General

The Contractor shall furnish all necessary tools, labor, machinery, apparatus, materials, equipment, service and other necessary supplies and do all work for a complete and operable facility as delineated in the Plans and Specifications at the unit or lump sum prices for the items listed in the Proposal.

These items refer to and are the same items listed in the Proposal and constitute all of the pay items under this Contract. Any other items of work listed in these Specifications or shown on the Plans shall be considered incidental to the following items.

2. Excavation

Payment for excavation will be made at the contract unit price shown in the Proposal per cubic yard complete including stripping, stockpiling and placing soil; hauling; disposal of excess or unsuitable materials. All accepted excavation at the Sludge Landfarm Facility will be measured by cross-sectioning the area of excavation before and after excavation. All excavation is considered unclassified.

Clearing and grubbing of all areas within the landfarm boundaries will be considered as a subsidiary obligation of the Contractor in connection with excavation and is not a separate pay item. All trench and/or structural excavation shall not be included in this pay item but shall be merged into the cost of the associated pipeline or structure pay item. Suitable excavated materials from landfarm site can be used for embankment, fill, or treatment zone material.

3. Embankment or Fill for Dike, Basin and Roadways

Payment for embankment or fill for dikes, basin and roadways will be made at the contract unit price shown in the Proposal per cubic yard complete including placement and compaction of all fills and embankments; sloping, shaping and dressing; stripping, excavation, stockpiling and hauling of any additional material required for fill from borrow pits away from boundaries of landfarm site; seeding; water required for compaction; disposal of unsuitable materials. All fill and embankments will be measured by cross-sectioning the landfarm site after excavation is completed and then after all fills and embankments have been placed.

Any excavation performed or fill placed beyond the limits shown on the Plans shall not be paid for by the Owner unless it is specifically authorized.

4. Treatment Zone Material

Payment for treatment zone material placed in the landfarm basins will be made at the contract unit price shown in the Proposal per cubic yard complete in place, including all incidental items of work involved with obtaining and placing the treatment zone material.

5. Sand

Payment for sand placed in the landfarm basin will be made at the contract unit price shown in the Proposal per cubic yard, complete in place, including all materials, labor and all incidental items of work involved.

6. Clay

Payment for clay placed in the landfarm basin will be made at the contract unit price shown in the Proposal per cubic yard, complete in place, including all materials, labor and all incidental items of work involved.

7. Class "A" Concrete for Headwalls

Class "A" concrete for headwalls shall be paid for at contract unit price shown in the Proposal complete in place including reinforcing steel, formwork, bolts, straps, other miscellaneous metals, earth excavation and all other incidental work involved.

8. Class "C" Concrete Encasement

Class "C" concrete for encasement will be paid for at the contract unit price shown in the Proposal per cubic yard, complete in place. This price shall include the providing of all steel bars, bolts and other steel products incidental to these structures.

9. Installing Concrete Pipe Ditches

Payment for installing the 15-inch concrete pipe (half section) ditch will be made at the contract unit price shown in the Proposal per linear foot complete in place, including trenching, jointing, hauling, backfilling, furnishing and installing Class "A" concrete at the transitions shown, and all other incidental work involved. The Owner will furnish the half sections of concrete pipe and stockpile them at a storage area near the landfarm facility. The cost of furnishing and installing the Class "A" reinforced concrete at the transitions shown on the Plans or any grouting required shall not be a separate pay item, but shall be merged into the cost of installing the concrete pipe ditch per linear foot.

10. Pipes and Culverts

Payment for pipes and culverts of the various sizes and materials shown will be made at the contract unit prices shown in the Proposal per linear foot complete in place, including pipe, fittings, trenching, gravel bedding or envelope, jointing, removal of water and all incidentals thereto, also including backfilling and end connections. The quantity to be paid for shall be the length of the pipe measured along the center line, without deducting for fittings. The cost of fittings is not a separate pay item but will be merged into the linear foot cost of the pipes. Some pipes may be included in the scope of work for other pay items and will not be included under this pay item.

The fabric wrap shall also be included in the unit price of the six-inch perforated underdrain.

11. Manholes

Manholes will be paid for at the contract unit price in the Proposal each, complete in place, and will include the manhole complete with footing, precast concrete rings, brickwork, bituminous painting, cast iron frame and cover, invert paving, through wall connections, concrete work, flat top, crushed stone, steps and all incidental work involved--all as shown on the Plans and more fully described herein, and all excavation and dewatering.

12. Landfarm Drainage Sump

The landfarm drainage sump will be paid for at the contract lump sum price shown on the Proposal, complete in place, including reinforced concrete pipe, concrete work, straps, through wall connections, withdrawal piping, vent, fittings, valves and couplings, steps, crushed stone, excavation, dewatering, backfilling and all incidental work involved as shown on the Plans or described in the Specifications.

13. Fence

Payment for fencing will be made at the contract unit price per linear foot as shown in the Proposal complete in place including the entrance gate, concrete and all incidental work involved. The entrance gate will not be a separate pay item but will be merged into the unit price for the fence.

14. Crushed Stone (Mineral Aggregate) for Roadways

Payment for crushed stone (mineral aggregate) for roadways and ramps will be made at the contract unit price per ton as shown in the Proposal. The weight of all surface moisture on the aggregate at the time of weighing in excess of eight percent will be deducted.

Subgrade construction and preparation is not a separate pay item but is considered incidental to the construction and preparation of the landfarm facility and shall be included in the items for excavation and fill.

15. Coarse Aggregate Fill for Erosion Belt

Payment for coarse aggregate fill for the erosion belt on the dikes will be made at the contract unit price per ton as shown in the Proposal. The weight of all surface moisture on the aggregate at the time of weighing in excess of eight percent will be deducted.

16. Yard Hose Rack Assembly

Payment for the yard hose rack assembly will be made at the contract lump sum price as shown in the Proposal, complete in place, including hose rack, painting, concrete work, and all incidental work involved.

17. Cleanout Assembly

Payment for cleanout assembly will be made at the contract unit price each as shown in the Proposal, complete in place, including all pipe, fittings, frame and cover, concrete and all incidental work involved.

18. Oil-Water Separator

The oil-water separator will be paid for at the contract lump sum price shown in the Proposal, complete in place, including oil-water separator, concrete work, precast concrete oil sump, piping, fittings, valves, excavation, backfilling, dewatering, crushed stone, frames and cover, and all incidental work involved as shown on the Plans or described in the Specifications.

The 8" and 12" pipe, fittings and valves from the manhole and headwall adjacent to the access road to the manhole north of the oil-water separator shall be included in the lump sum price for the separator as shown on the Plans, including the concrete encasement. The headwalls, manholes and roadways shall be separate pay items.

* * *

BID SCHEDULE

ITEM NO.	APPROXIMATE QUANTITY	DESCRIPTION WITH UNIT BID PRICE WRITTEN IN WORDS	UNIT PRICE	TOTAL PRICE
1.	5,680 C.Y.	Unclassified Excavation For______________________ ________________________ Dollars__________________ Cents, per Cubic Yard	$__________	$__________
2.	11,510 C.Y.	Embankment or Fill for Dike, Basin and Roadways For______________________ ________________________ Dollars__________________ Cents, per Cubic Yard	$__________	$__________
3.	12,970 C.Y.	Treatment Zone Material For______________________ ________________________ Dollars__________________ Cents, per Cubic Yard	$__________	$__________
4.	5,950 C.Y.	Sand For______________________ ________________________ Dollars__________________ Cents, per Cubic Yard	$__________	$__________
5.	6,980 C.Y.	Clay Layer For______________________ ________________________ Dollars__________________ Cents, per Cubic Yard	$__________	$__________

ITEM NO.	APPROXIMATE QUANTITY	DESCRIPTION WITH UNIT BID PRICE WRITTEN IN WORDS	UNIT PRICE	TOTAL PRICE
6.	6 C.Y.	Class "A" Concrete Headwalls, complete in place For________________ ___________________ Dollars_____________ Cents, per Cubic Yard	$________	$________
7.	25 C.Y.	Class "C" Concrete for Encasement For________________ ___________________ Dollars_____________ Cents, per Cubic Yard	$________	$________
8.	1,115 L.F.	Installation Only of 15"(Half Section) Concrete Pipe Ditch, including furnishing and installing Class "A" Concrete transitions, complete in place For________________ ___________________ Dollars_____________ Cents, per Linear Foot	$________	$________
9.	58 L.F.	15-inch Reinforced Concrete Pipe Culvert, complete in place For________________ ___________________ Dollars_____________ Cents, per Linear Foot	$________	$________
10.	170 L.F.	8-inch Concrete Pipe Culvert, complete in Place For________________ ___________________ Dollars_____________ Cents, per Linear Foot	$________	$________

ITEM NO.	APPROXIMATE QUANTITY	DESCRIPTION WITH UNIT BID PRICE WRITTEN IN WORDS	UNIT PRICE	TOTAL PRICE
11.	40 L.F.	12-inch Ductile Iron Pipe, complete in place For______________________ _________________________ Dollars__________________ Cents, per Linear Foot	$____________	$____________
12.	875 L.F.	6-inch Perforated Underdrain with Fabric Wrap, complete in place For______________________ _________________________ Dollars__________________ Cents, per Linear Foot	$____________	$____________
13.	350 L.F.	6-inch PVC Pipe, complete in place For______________________ _________________________ Dollars__________________ Cents, per Linear Foot	$____________	$____________
14.	2 EACH	Precast Manholes, complete in place For______________________ _________________________ Dollars__________________ Cents, Each	$____________	$____________
15.	1 L.S.	Landfarm Drainage Sump, complete in place For______________________ _________________________ Dollars__________________ Cents, Lump Sum		$____________

ITEM NO.	APPROXIMATE QUANTITY	DESCRIPTION WITH UNIT BID PRICE WRITTEN IN WORDS	UNIT PRICE	TOTAL PRICE
16.	1 L.S.	Oil Water Separator including Oil Sump, complete in place For____________________ ________________________ Dollars________________ Cents, Lump Sum		$________________
17.	2,595 L.F.	Chain Link Fence, complete in place For____________________ ________________________ Dollars________________ Cents, per Linear Foot	$____________	$________________
18.	1,700 TONS	Crushed Stone Aggregate for Roadways and Ramps, complete in place For____________________ ________________________ Dollars________________ Cents, per Ton	$____________	$________________
19.	2,300 TONS	Coarse Aggregate Fill for Dike Erosion Belt, complete in place For____________________ ________________________ Dollars________________ Cents, per Ton	$____________	$________________
20.	1 L.S.	Yard Hose Rack Assembly, complete in place For____________________ ________________________ Dollars________________ Cents, Lump Sum		$________________

ITEM NO.	APPROXIMATE QUANTITY	DESCRIPTION WITH UNIT BID PRICE WRITTEN IN WORDS	UNIT PRICE	TOTAL PRICE
21.	5 EACH	Cleanout Assembly, complete in place For________________ ___________________ Dollars____________ Cents, Each	$________	$________
22.	1 EACH	6-inch MJ Gate Valve and Box, complete in place For________________ ___________________ Dollars____________ Cents, Each	$________	$________

TOTAL BID PRICE
ITEMS 1 THRU 22,
INCLUSIVE $____________________

APPENDIX 2
Groundwater Elevation Assessment
(Soil Boring Logs/Well Logs)

GROUNDWATER ELEVATION ASSESSMENT
FOR NO. 1 LANDFARM

Prepared for:

Amerada Hess Corporation
Port Reading Refinery

Prepared by:

AWARE Incorporated
621 Mainstream Drive, Suite 200, Metro Center
Nashville, Tennessee 37228

April 1985

AWARE

consultants in environmental management

April 2, 1985

6429

Dr. T. Helfgott
Manager, Environmental Affairs
Amerada Hess Corporation
One Hess Plaza
Woodbridge, NJ 07095

RE: Groundwater Elevation Assessment
at the No. 1 Landfarm

Dear Dr. Helfgott:

AWARE has evaluated the groundwater table elevations in the area to be used for construction of the proposed No. 1 Landfarm at the Port Reading Refinery. An initial evaluation was conducted in conjunction with the landfarm design project conducted by AWARE and was presented in a report titled "Detailed Engineering Design for the No. 1 Landfarm", June 1984. Additional water table evaluations were conducted during November and December 1984 in conjunction with landfarm design revisions. The report contained herein presents the data and conclusions reached during both groundwater evaluation periods.

The groundwater levels in the area to be used for the No. 1 Landfarm at the Port Reading Refinery were initially determined using three water table observation wells constructed in the proposed area. The water table contour map presented in the Detailed Engineering Design Report (AWARE, June 1984) was constructed using the water table elevations measured in these wells on April 10, 1984. These data provided the shape of the water table surface and the direction of groundwater movement in the area. This information was used to select the proposed well locations for the required upgradient and downgradient monitoring wells.

The New Jersey regulations state that the bottom of the treatment zone must be located at least three feet above the seasonal high water table elevation. Water table elevations have been measured during the last four years and the highest groundwater elevations occur in the spring season of the year. Water level measurements were made in the observation wells in February, March, and April of 1984 prior to submittal of the Engineering Design Report in June 1984. The water table elevation determined from these measurements (observation wells OW-1, OW-2, OW-3) are shown in Table 1 and Figure 1. It is noted that the water level measurements from OW-1 are suspect because the well screen was extended to land surface. During periods of precipitation, water has been ponded around the observation well (specifically for the measurement made on March 30, 1984), and these data are thought to be compromised from the standing water seeping into the well. Water table elevations were also available for a longer period of time from the adjacent RCRA monitoring well, W-4, at the existing North Landfarm. The water table elevations for Well W-4 are also shown in Table 1.

The water level measurements made in Well W-4 showed a water level difference of 2.69 ft during the three years of record and an elevation difference of 2.24 ft from the maximum measured water level elevation of 7.19 ft elevation in April 1982 and the measured 4.75 ft elevation in February 1984. The seasonal trends shown by the data from Well W-4 also indicate that the water table elevations measured in Wells OW-1, OW-2, and OW-3 during March and April 1984 likely represented the seasonal high water table elevation for the period of record. The seasonal trends in the measured water table elevations are illustrated by the hydrographs in Figures 2 and 3.

Additional work was completed in November, 1984 to further evaluate the water table gradient and the projected elevation of the seasonal high water table. This work was done in conjunction with the landfarm design revisions. Test pits were installed at fourteen locations on November 14, 1984 in the proposed area for No. 1 Landfarm (Figure 4). Logs of the soil descriptions for each test pit are contained in Attachment 1. The depth to groundwater was measured in each test pit after allowing the water level to stabilize for several hours. The water level measurements and calculated water table elevations are shown in Table 2. Water level measurements were also made in Wells OW-1, OW-2, OW-3, and W-4 on November 15, 1984 (Table 1). The water table elevation contours using the test pit measurements are shown on Figure 5. The water table elevations showed that the groundwater gradient was relatively flat (0.001 to 0.004 ft/ft) over the eastern half of the landfill area and steepened to 0.01 to 0.02 ft/ft over the western half of the area. These data were consistent with the data used during development of the Engineering Design Report.

The water table elevations measured in Wells OW-1, OW-2, and OW-3 on November 15, 1984 were found to be much lower than those measured in March and April 1984 and were representative of the seasonal low water table elevations during the fall or drier season. The range in fluctuations between spring and fall was 2.5 ft in OW-1, 3.7 ft in OW-2, and 1.7 ft in OW-3.

The seasonal high water table elevations for the landfarm redesign were estimated to range from 2.5 ft above the November elevations along the eastern edge of the proposed landfarm area to 3.0 ft above the November elevations in the center of the area and 1.7 ft above the November elevations in the western portion of the area. The seasonal high water table elevation was projected to range from 10.5 ft elevation along the eastern border of the landfarm area down to 5.0 ft elevation along the western border of the landfarm area. The estimated seasonal high water table elevations are shown by the water table elevation contours in Figure 6.

Amerada Hess had five groundwater monitoring wells installed around the perimeter of the proposed No. 1 Landfarm area on November 29, 1984. The well construction details are contained in the Dames and Moore Report, Groundwater Observation Well Installations contained in Attachment 2. These wells were used to provide additional water level data and will be used for groundwater quality monitoring prior to and during use of the landfarm. The water table contour elevations determined from the November 29, 1984 round of water level measurements are shown in Figure 7.

We believe that the above explanation documents the evaluation we followed to determine the seasonal high water table elevations as well as the groundwater gradient under the landfarm site. The additional water table elevations determined from the November 1984 data indicate the previously projected seasonal high water table elevations were correct.

If you have any questions concerning this report and the water table evaluations, please contact us.

Sincerely,

AWARE Incorporated

Michael R. Groves/gmp

Michael R. Groves
Senior Hydrogeologist

Jeffrey L. Pintenich
Principal

cc: S. R. Tate
M. R. Corn, Consultant

TABLE 1

WATER LEVEL ELEVATIONS FOR THE GROUNDWATER MONITORING WELLS

Date	Water Level Elevation, Feet Above NGVD			
	OW-1	OW-2	OW-3	W-4
12-17-81				(6.27)[a]
1-12-82				(8.62)[a]
2-16-82				5.31
3-10-82				5.77
4-20-82				7.19
5-4-82				4.75
5-12-82				4.75
8-18-82				4.79
3-2-83				5.1
4-28-83				6.9
7-11-83				4.87
10-17-83				4.5
1-23-84	(Observations Wells installed February 1984)			4.5
2-15-84	10.40	7.67	4.44	--
2-21-84	9.71	8.08	4.41	--
2-21-84	--	--	4.54	--
2-22-84	9.86	8.02	4.44	4.75
2-23-84	--	--	4.5	--
3-30-84	11.56[b]	9.64	5.52	--
4-10-84	10.36	9.70	4.99	5.06
11-15-84	8.0	6.0	3.80	5.5

[a]( ) suspect-water levels which are thought to be in error due to measurement problems during implementation of groundwater monitoring program.

[b]Well OW-1 is screened to land surface and the area exhibits surface water ponding. It is felt that this measurement (approximately land surface) is affected by surface water filling the well.

TABLE 2

WATER TABLE ELEVATIONS MEASURED IN TEST PITS ON NOVEMBER 14, 1984

Test Pit No.	Land Surface Elevation (NGVD)[a]	Depth to Water (ft)	Water Table Elevation (NGVD)[a]
1	11.6	6.7	4.9
2	11.5	7.3	4.2
3	9.3	5.6	3.7
4	10.7	4.2	6.5
5	12.1	4.8	7.3
6	10.3	3.4	6.9
7	12.4	4.9	7.5
8	11.3	4.1	7.2
9	13.1	5.6	7.5
10	12.8	5.0	7.8
11	12.5	4.7	7.8
12	12.3	4.2	8.1
13	10.7	2.8	7.9
14	11.5	4.4	7.1

[a]NGVD denotes feet above the National Geodetic Vertical Datum of 1929.

FIGURE 1 WATER TABLE ELEVATION CONTOUR MAP USING WATER LEVEL MEASUREMENTS MADE IN OBSERVATION WELLS ON 4/10/84

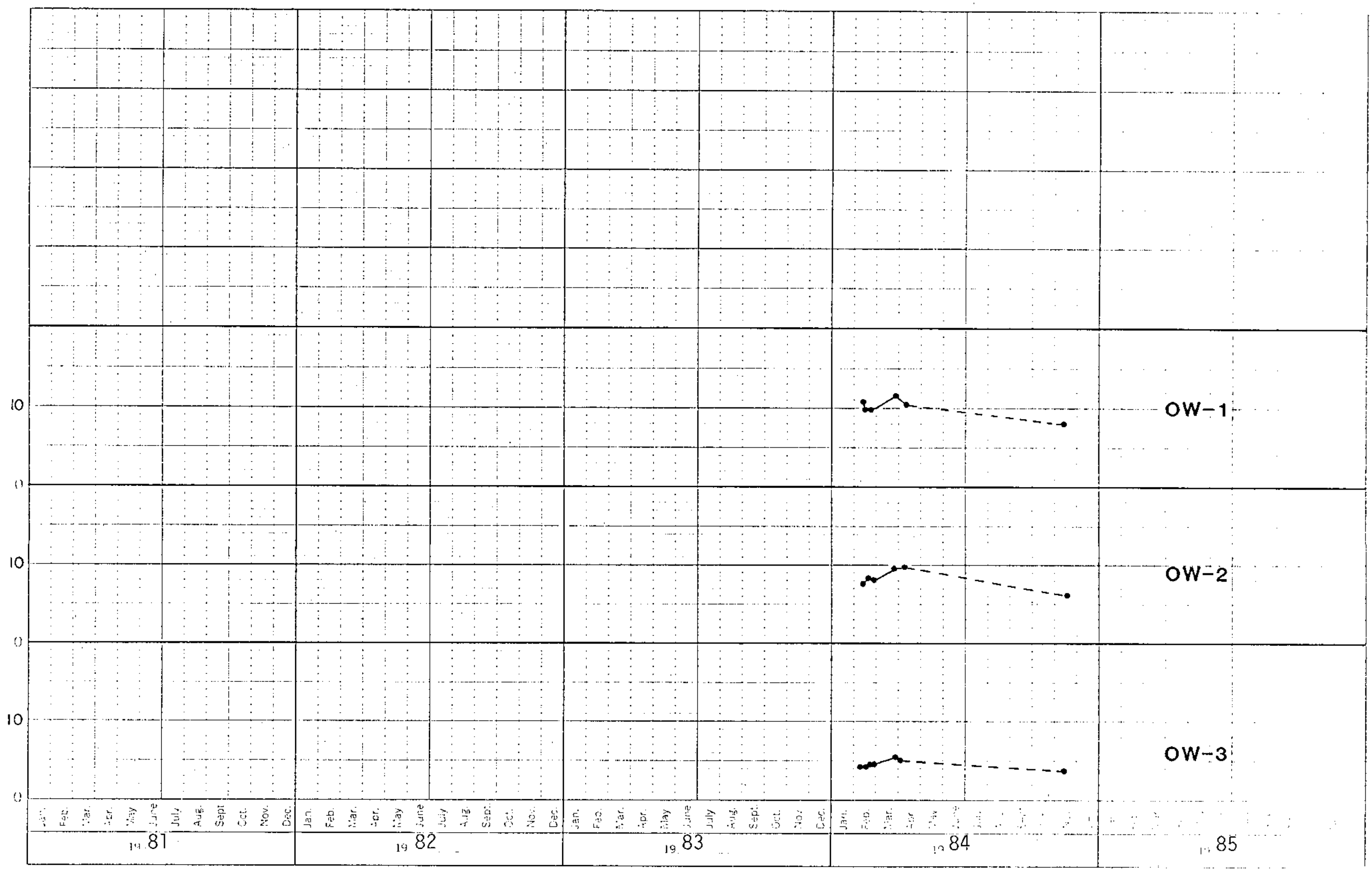


FIGURE 2 HYDROGRAPH SHOWING WATER TABLE ELEVATIONS MEASURED IN TEMPORARY OBSERVATION WELLS

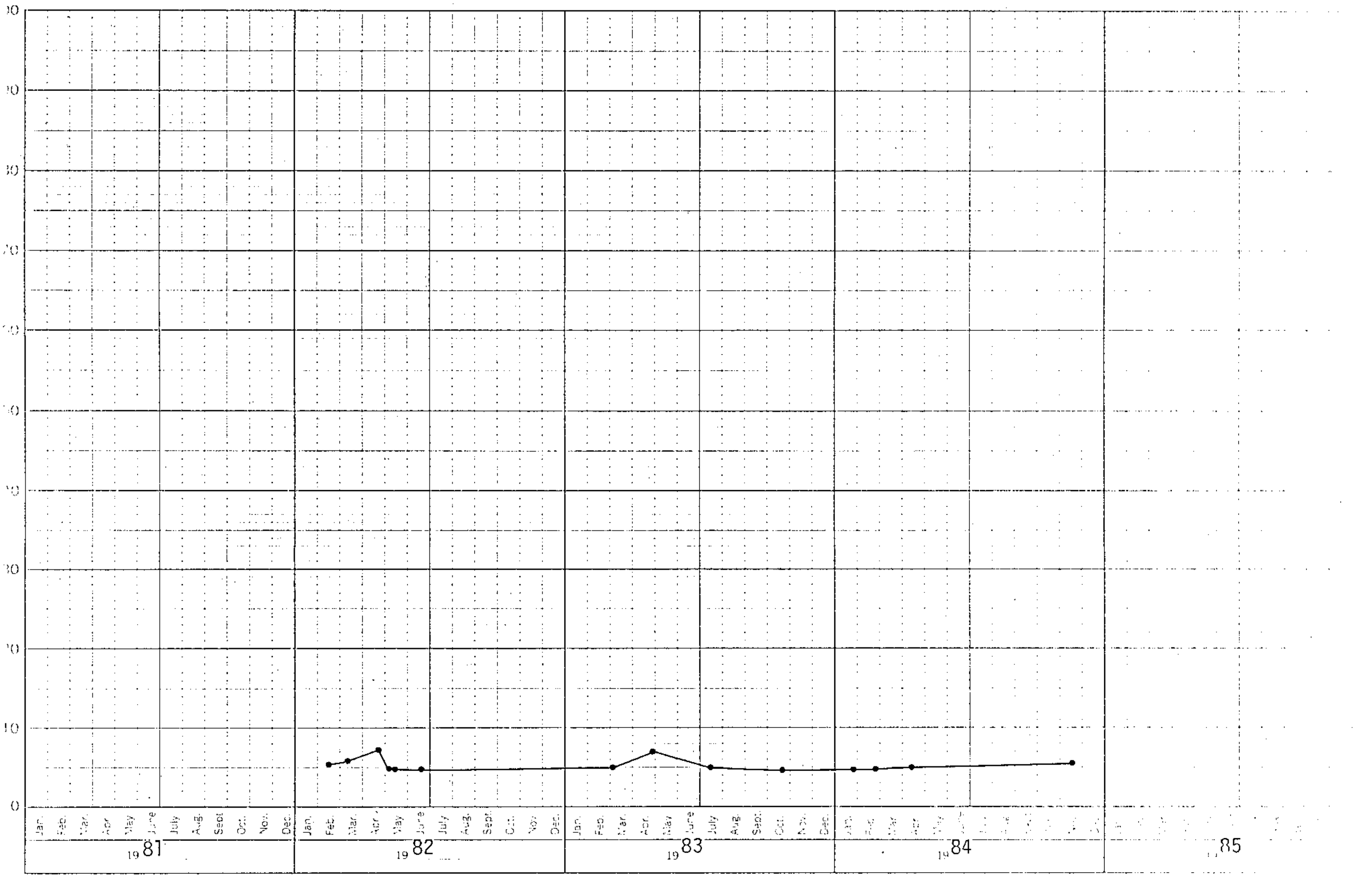


FIGURE 3 HYDROGRAPH SHOWING WATER TABLE ELEVATION MEASUREMENTS IN WELL W-4

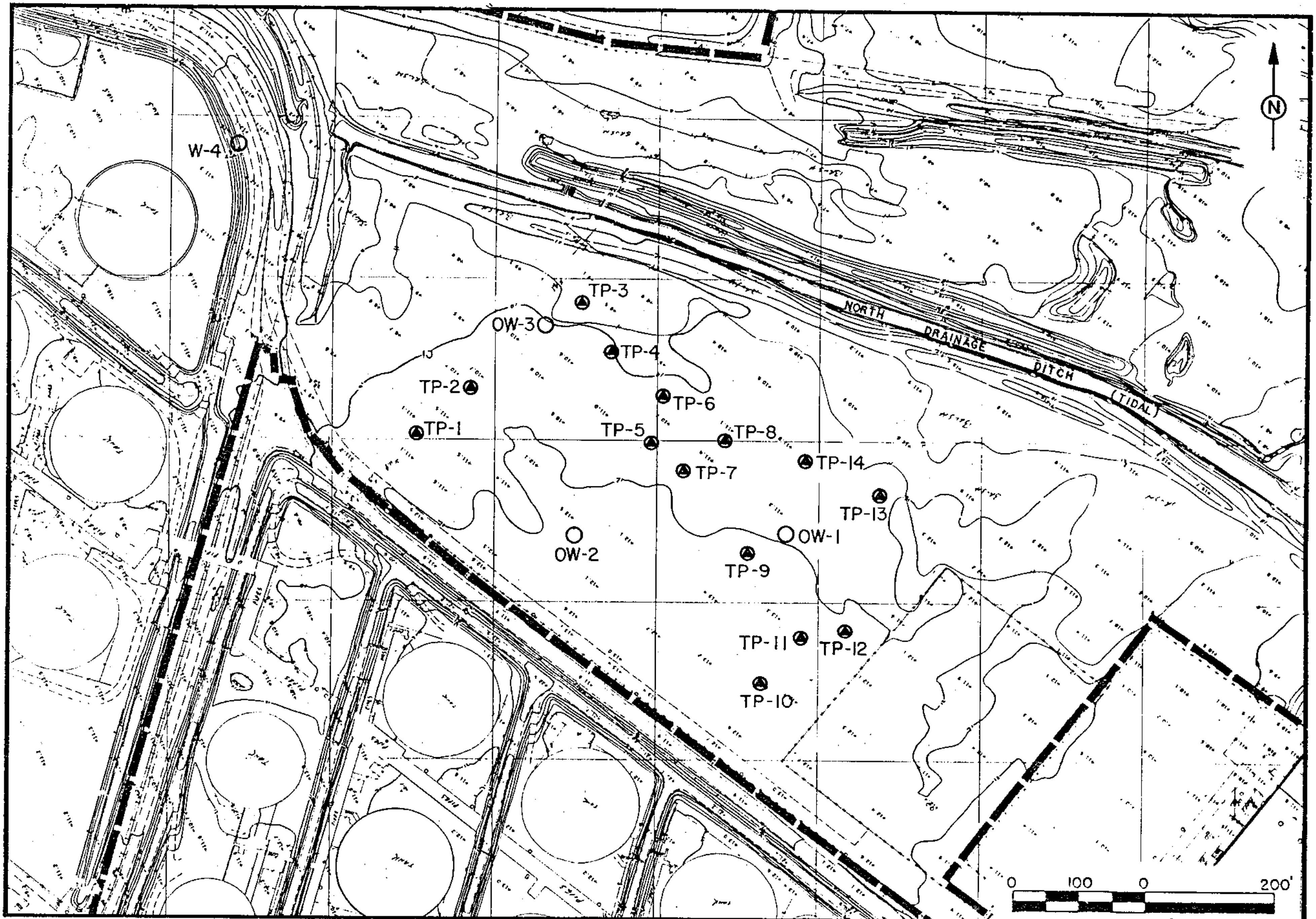


FIGURE 4 LOCATIONS OF TEST PITS EXCAVATED ON 11/14/84

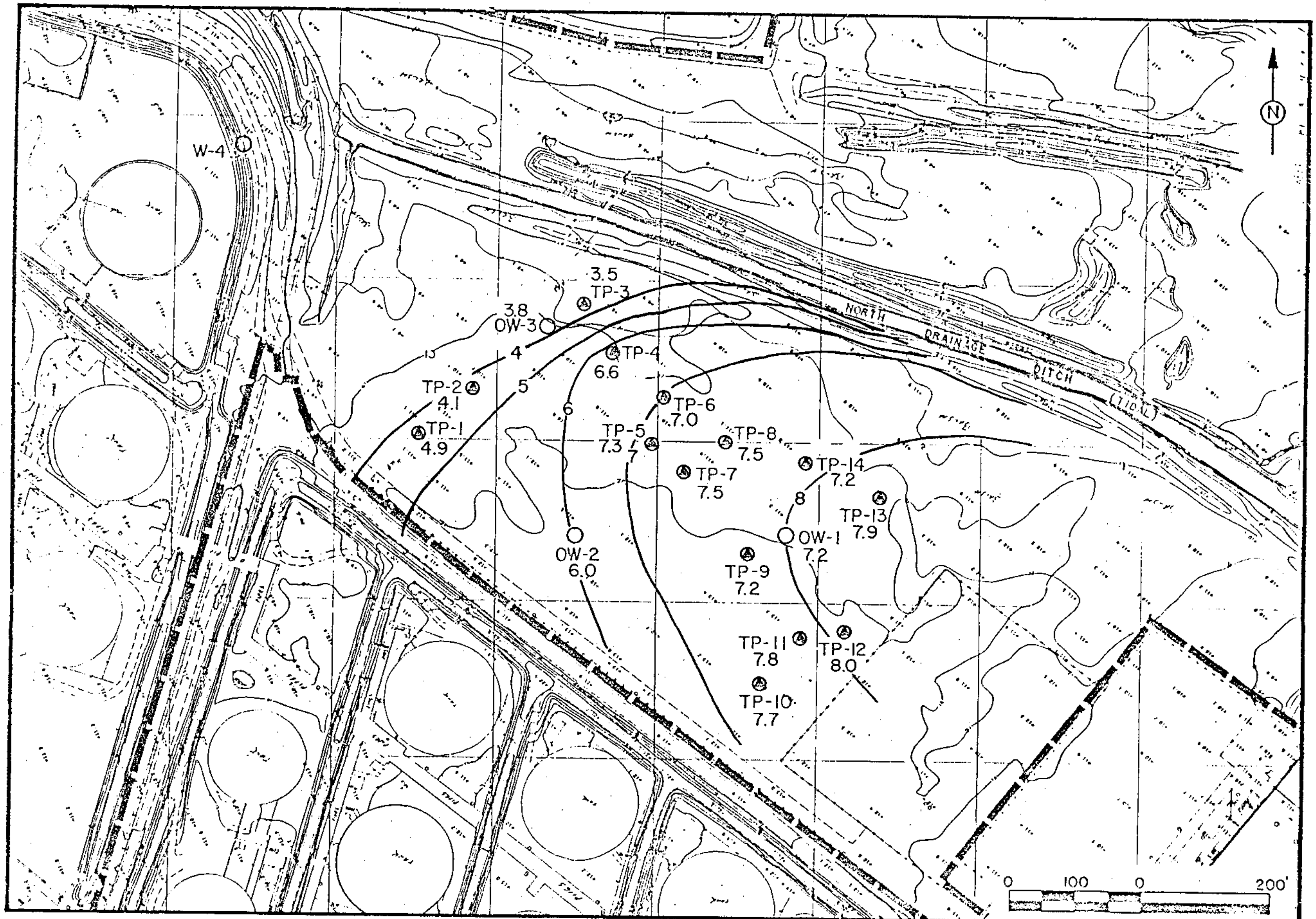


FIGURE 5 WATER TABLE ELEVATION CONTOUR MAP USING WATER TABLE ELEVATIONS MEASURED IN TEST PITS ON 11/14/84 AND OBSERVATION WELLS ON 11/15/84

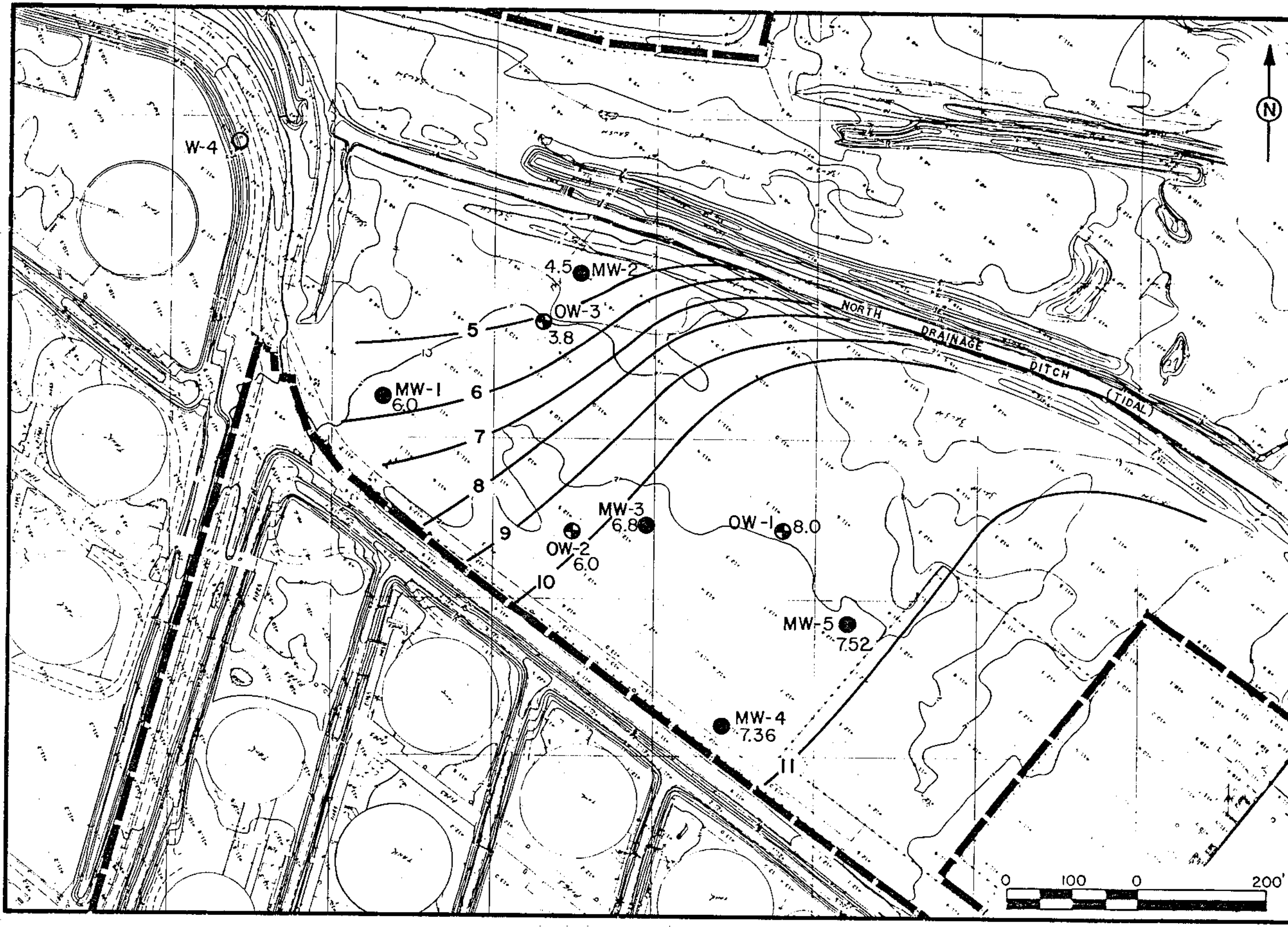


FIGURE 6 OBSERVATION WELL LOCATIONS AND PROJECTED SEASONAL HIGH WATER TABLE ELEVATION CONTOURS

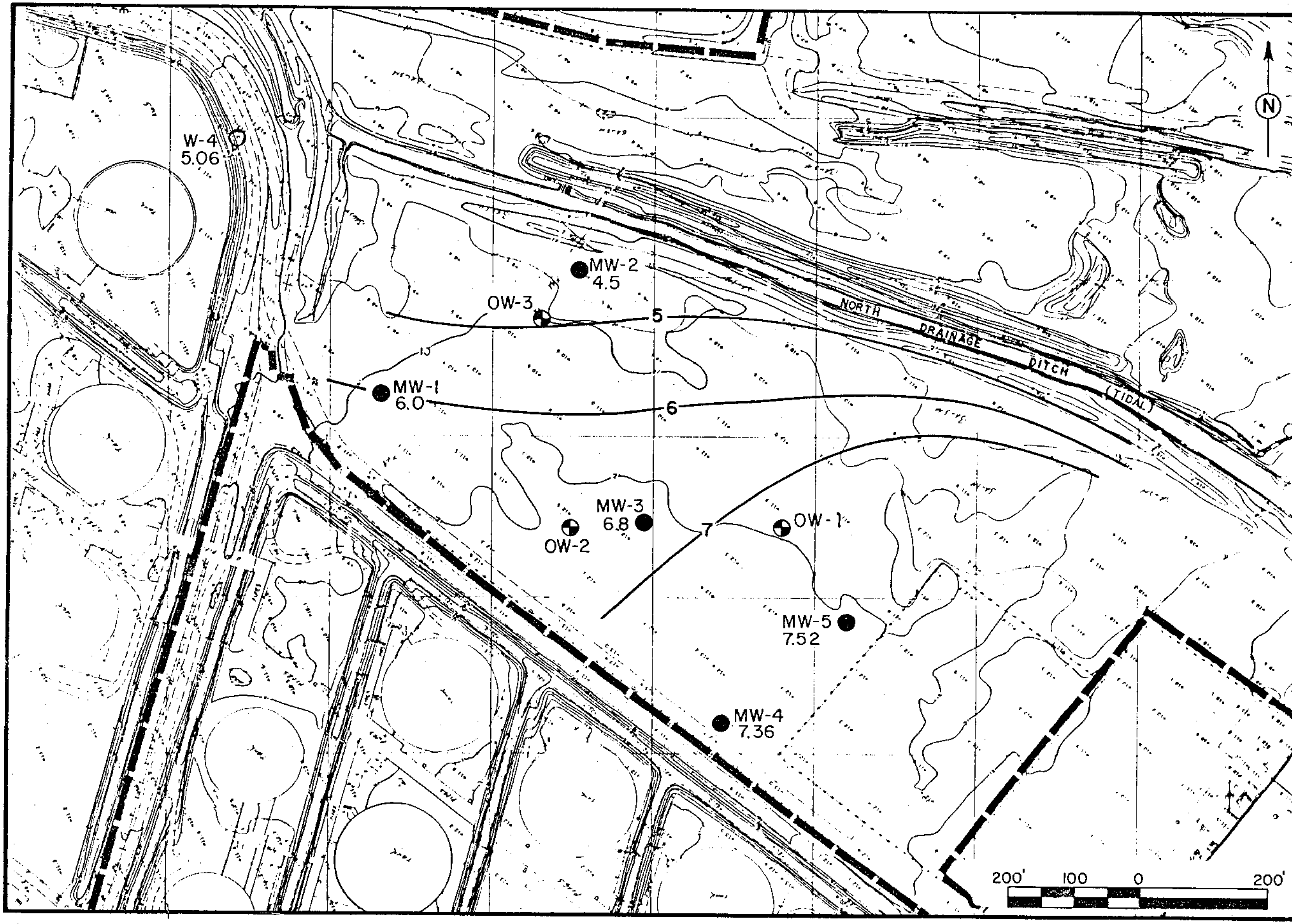


FIGURE 7 WATER TABLE ELEVATION CONTOUR MAP USING WATER LEVELS MEASURED IN NEW MONITORING WELLS ON 12/10/84

ATTACHMENT 1

LOGS OF TEST PITS

LOGS OF TEST PITS

Test Pit 1 (Grade Elevation = 11.6 ft)

0 - 4.6 ft	Brown silty, fine to coarse sand, gravel, and some pebbles. Aslphalt rubble in top 2 ft. SM
4.6 - 8 ft	Gray brown fine to medium sand with gravel and pebbles. Streaks of reddish gray clay. Oily. SP
8 ft - 9 ft	Gray to black clayey sand with gravel, pebbles and cobbles. GC

Test Pit 2 (Grade Elevation = 11.5 ft)

0 - 4 ft	Brown, fine to coarse sand with gravel and some pebbles. SP
4 ft - 8 ft	Gray to black sand with rounded gravel and pebbles. SP

Test Pit 3 (Grade Elevation = 9.3 ft)

0 - 2.5 ft	Reddish brown silty fine sand. SM
2.5 ft - 4.5 ft	Gray brown clayey, silty fine sand, marsh odor. OL
4.5 ft - 6 ft	Dark gray fine to coarse sand with gravel, pebbles and some cobbles, rounded. SP

Test Pit 4 (Grade Elevation = 10.7 ft)

0 - 2.7 ft	Brown medium sand with some coarse sand and gravel. SP
2.7 ft - 5 ft	Gray to black clayey silt. (Water entering pit at 2.7 ft depth.) OH/PT
5 ft - 7 ft	Gray to black silty coarse sand with some gravel, pebbles and cobbles, rounded. (Water entering pit at 5 ft depth.) SP

Test Pit 5 (Grade Elevation = 12.1 ft)

0 - 0.5 ft	Topsoil
0.5 ft - 4.75 ft	Reddish brown fine to coarse sand with gravel and pebbles. SP
4.75 ft - 5.3 ft	Dark gray to black, silty sand, wet. SM/PT
5.3 ft - 6 ft	Dark gray to black, fine to coarse sand with gravel, pebbles and cobbles, rounded. (Water entering pit at 5.3 ft depth.) SP

Test Pit 6 (Grade Elevation = 10.3 ft)

0 - 1 ft	Topsoil, brown silty sand. SM
1 ft - 2.7 ft	Reddish brown, medium sand with gravel. SP
2.7 ft - 5 ft	Grayish brown, medium to coarse sand with gravel, pebbles and cobbles, rounded. Wet. SP

Test Pit 7 (Grade Elevation = 12.4 ft)

0 - 0.3 ft	Topsoil, brown silty sand. SM
0.3 ft - 5 ft	Reddish brown, fine to coarse sand with gravel. SP
5 ft - 6.7 ft	Gray brown, fine to coarse sand with gravel. (Water entering pit at 5.7 ft depth.) SP
6.7 ft - 7.7 ft	Gray to black and reddish brown, streaked, sandy, clayey silty. CL

Test Pit 8 (Grade Elevation = 11.3 ft)

0 - 1.3 ft	Topsoil, brown sandy silt. SM
1.3 ft - 2.7 ft	Reddish brown, medium sand with gravel. SW

2.7 ft - 4 ft	Reddish brown sand and gray silty sand in layers. SW/SM
4 ft - 6 ft	Gray to black, medium to coarse sand with gravel, pebbles and cobbles, rounded. SP

Test Pit 9 (Grade Elevation = 13.1 ft)

0 - 2.7 ft	Reddish brown, fine to medium sand with seams of coarse sand, gravel and pebbles. SP
2.7 ft - 4.3 ft	Reddish brown, fine to medium sand. SW
4.3 ft - 6 ft	Reddish brown, coarse sand with gravel and pebbles. SP

Test Pit 10 (Grade Elevation = 12.8 ft)

0 - 4 ft	Brown, fine to coarse sand with some gravel and pebbles. SP
4 ft - 6 ft	Grayish brown, fine to coarse sand with gravel and pebbles. (Water entering pit at 6 ft depth.) SP

Test Pit 11 (Grade Elevation = 12.5 ft)

0 - 4.6 ft	Brown, medium to coarse sand with rounded gravel. SP
4.6 ft - 7.5 ft	Reddish brown and gray streaks, clayey, sandy, silt. (Water entering pit at 5 ft depth.) CL

Test Pit 12 (Grade Elevation = 12.3 ft)

0 - 5.8 ft	Brown, medium to coarse sand with some gravel and pebbles. (Water entering pit at 5 ft depth.) SP

Test Pit 13 (Grade Elevation = 10.7 ft)

0 - 1 ft	Topsoil, brown silty sand. MH

1 ft - 3 ft	Reddish brown, medium sand. SW
3 ft - 4 ft	Gray, coarse sand and gravel, wet. SP
4 ft - 6 ft	Gray, coarse sand and gray clayey silt layers. (Water entering pit at 4.3 ft depth.) SW/OH

<u>Test Pit 14</u> (Grade Elevation = 11.5 ft)

0 - 5 ft	Brown, medium to coarse sand with gravel. (Water entering pit at 4.3 ft depth.) SP
5 ft - 6 ft	Gray, fine to coarse sand and gravel with some streaks of black silty clay. SP/OH(PT)

ATTACHMENT 2

DAMES AND MOORE REPORT
GROUNDWATER OBSERVATION WELL INSTALLATIONS
February 11, 1985

Dames & Moore
6 Commerce Drive
Cranford, New Jersey 07016
(201) 272-8300
TWX 710-996-5806 Cable address DAMEMORE

February 11, 1985

Amerada Hess Corporation
One Hess Plaza
Woodbridge, New Jersey 07095

Attention: Dr. T. Helfgott

Re: Letter Report
Ground Water Observation Well Installations
Proposed Land Farm
Port Reading Refinery
Port Reading, New Jersey
Amerada Hess Corporation

Dear Dr. Helfgott:

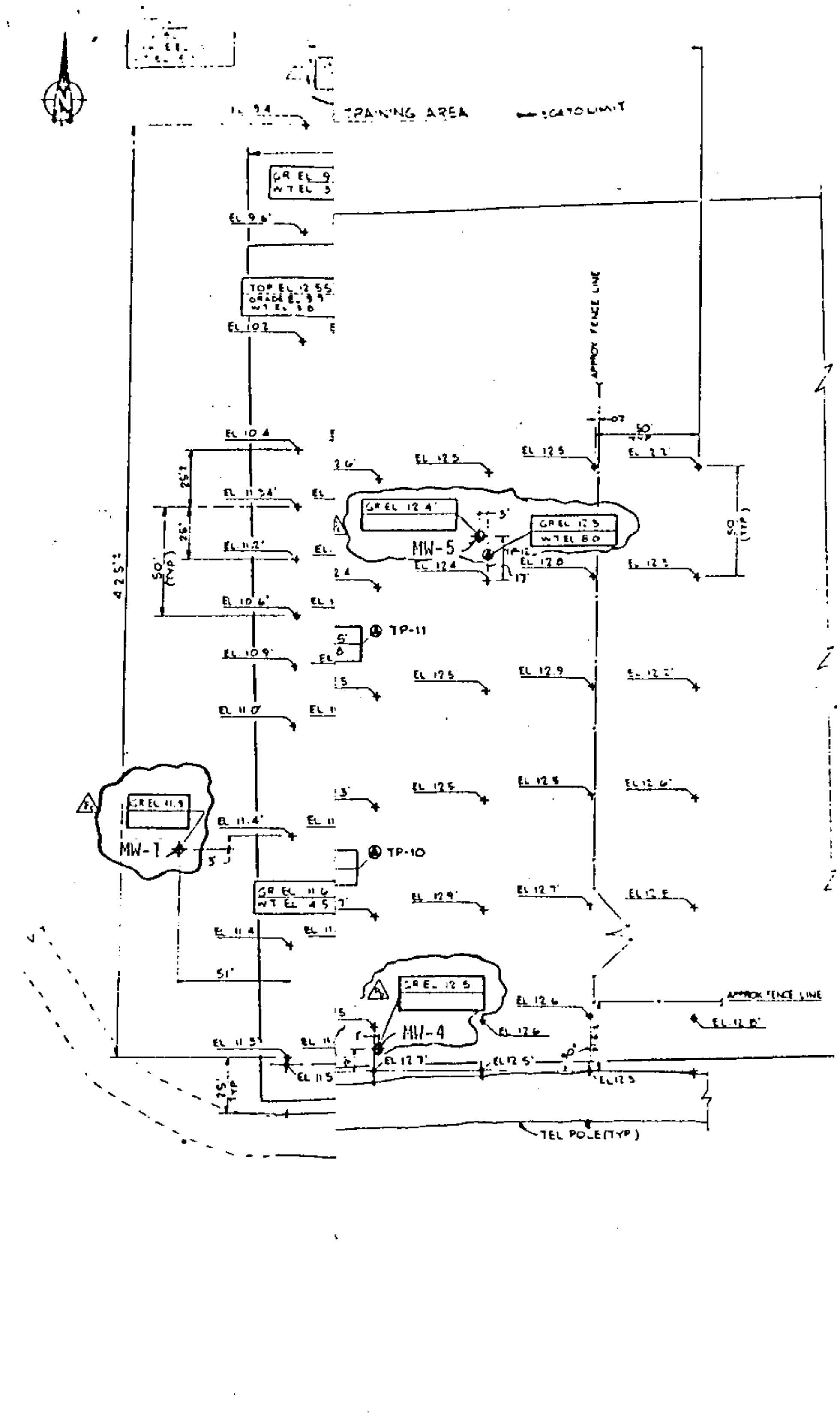
This letter report presents the results of the ground water observation well installations performed for Amerada Hess Corporation. The requirements and scope of work were obtained from Mr. Groves of Aware in a conversation on November 7, 1984 and are outlined in our proposal of November 21, 1984. In addition, Dr. Helfgott asked Dames & Moore to provide a ground water table contour map in a conversation on December 3, 1984.

The purpose of our work was to drill and install five shallow ground water observation wells in each. The work was performed in conjunction with a hydrogeologic investigation at the site of a proposed land farm. The location of each observation well was determined by Mr. Groves of Aware (Figure 1).

The wells were drilled and installed by Lippencott Engineering Associates on November 29, 1984. The boreholes were advanced by a CME truck-mounted drilling rig, using 6-inch O.D. hollow stem augers. Borings penetrated approximately 10 feet of sand and were completed in the top of the silty to clayey organic peat layer which immediately underlies the sand. Samples were taken at depths of 5 and 10 feet in each boring with a standard split spoon sampler. Logs of each boring were recorded and are presented in Figures 2 and 3.

Each observation well was then completed by installing five feet of 2-inch I.D. Schedule 40 PVC screen (slot size equal .020 inch) to the base of the borehole. The screen was connected to PVC riser pipe which extended above the ground surface. A sand pack was then placed in the annular space to approximately one foot above the top of the well screen. A bentonite seal was then placed above the sand pack. The remaining annular space was then filled with a cement grout. A steel protective casing with locking cap was then placed over the top of the well casing and secured in the cement. Well construction details are presented graphically in Figures 2 and 3. Each well was then developed by surging and pumping with a centrifugal pump until the water was reasonably clear of silt and sand.

The wells were allowed to stabilize for several days prior to water level measurements being recorded in order to obtain accurate measurements.



REFERENCE:
AMERADA HESS CORPORATION D
TITLED "PLAN GRID ELEVATIO

DAMES & MOORE

FIGURE 1

GROUND WATER ELEVATIONS

Well	Ground Water Elevations
MW-1	6.0
MW-2	4.5
MW-3	6.8
MW-4	7.36
MW-5	7.52

All field work was performed under the supervision of Dames & Moore Assistant Geologist, William McCune.

The following figures are attached and complete this report:

Figure 1 — Water Table Contour Map

Figures 2 and 3 — Logs of Boring and Diagrams of Well Installations

Figure 4 — Unified Soil Classification System

If you have any questions or comments, please contact us.

Very truly yours,

DAMES & MOORE

William T. McCune

William T. McCune
Project Manager

WTM:jp

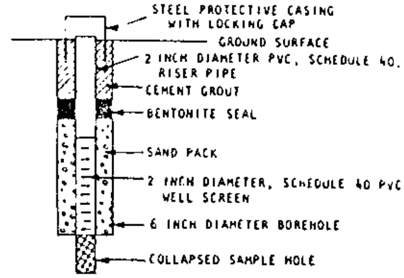
Attachments

BORING MW-1

SURFACE ELEVATION

DEPTH IN FEET	BLOW COUNT	SAMPLES	SYMBOLS	DESCRIPTIONS
0			SP	REDDISH BROWN FINE TO MEDIUM SAND, SOME GRAVEL (FILL)
5	38	▫	SM	DARK BROWN FINE SAND, TRACE TO LITTLE SILT, TRACE TO LITTLE GRAVEL (FILL) (SATURATED)
10	38	▫	PT	BLACK CLAYEY PEAT, SOME SAND, TRACE GRAVEL
15				

BORING COMPLETED AT DEPTH OF 12 FEET ON 11/29/84
WATER ENCOUNTERED AT DEPTH OF 5.89 FEET BELOW GROUND SURFACE ON 12/2/84

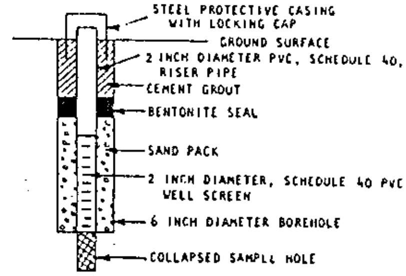


BORING MW-2

SURFACE ELEVATION

DEPTH IN FEET	BLOW COUNT	SAMPLES	SYMBOLS	DESCRIPTIONS
0			SP	BROWN VERY FINE TO FINE SAND, TRACE SILT (FILL)
5	16	▫	SM	BLACK SAND WITH SOME ORGANICS, LITTLE GRAVEL (SATURATED)
				GRADING WITH SOME GRAVEL
10	2	▫	PT	GREENISH GRAY SILTY TO CLAYEY PEAT, ORGANICS, TRACE ROOTS
15				

BORING COMPLETED AT A DEPTH OF 12 FEET ON 11/29/84.
WATER ENCOUNTERED AT A DEPTH OF 5.85 FEET BELOW GROUND SURFACE ON 12/2/84



LOG OF BORINGS AND MONITORING WELL DETAILS

NOTES:

1. THE FIGURES IN THE COLUMN LABELED "BLOW COUNT" REFER TO THE NUMBER OF BLOWS REQUIRED TO DRIVE A STANDARD SPLIT-SPOON SAMPLER A DISTANCE OF ONE FOOT USING A 140 POUND DRIVE WEIGHT FALLING 30 INCHES. THE STANDARD SPLIT-SPOON SAMPLER IS 2" O.D. AND 1-3/8" I.D.
2. THE DISCUSSION IN THE TEXT OF THE REPORT IS NECESSARY FOR A PROPER UNDERSTANDING OF THE NATURE OF THE SUBSURFACE MATERIALS.

Dames & Moore

BORING MW-3

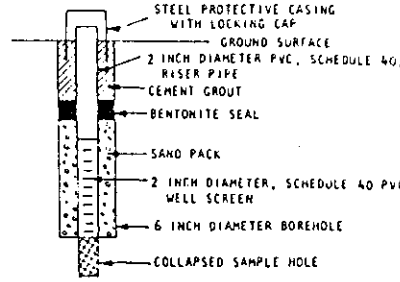
SURFACE ELEVATION

DEPTH IN FEET | SAMPLES | BLOW COUNT | SYMBOLS | DESCRIPTIONS

Depth (ft)	Blow Count	Symbol	Description
0		SP	REDDISH BROWN MEDIUM SAND, TRACE TO LITTLE GRAVEL, TRACE SILT (FILL)
5	2	SP	DARK BROWN GRAY SAND, TRACE GRAVEL, TRACE SILT (SATURATED)
10	2	PT	BLACK CLAYEY PEAT WITH SOME SAND GRADING WITH MORE ORGANIC MATTER
15			

BORING COMPLETED AT A DEPTH OF 12 FEET ON 11/29/84

WATER ENCOUNTERED AT A DEPTH OF 5.9 FEET BELOW GROUND SURFACE ON 12/2/84



BORING MW-4

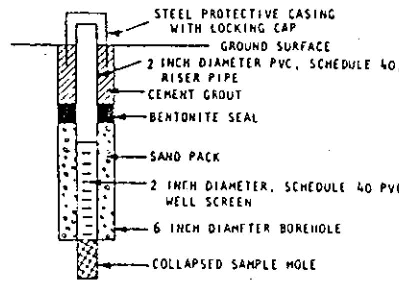
SURFACE ELEVATION

DEPTH IN FEET | SAMPLES | BLOW COUNT | SYMBOLS | DESCRIPTIONS

Depth (ft)	Blow Count	Symbol	Description
0		SP	REDDISH BROWN SAND, LITTLE TO SOME GRAVEL, TRACE SILT (FILL)
5	25	SP	DARK BROWN TO GRAY BROWN SAND, LITTLE GRAVEL, TRACE SILT (SATURATED)
10	2	PT	BLACK ORGANIC SANDY PEAT
15			

BORING COMPLETED AT A DEPTH OF 12 FEET ON 11/29/84.

WATER ENCOUNTERED AT A DEPTH OF 6.14 FEET BELOW GROUND SURFACE ON 12/2/84



BORING MW-5

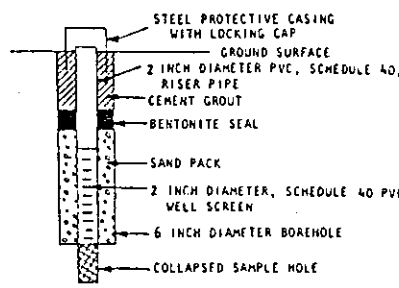
SURFACE ELEVATION

DEPTH IN FEET | SAMPLES | BLOW COUNT | SYMBOLS | DESCRIPTIONS

Depth (ft)	Blow Count	Symbol	Description
0		SP	BROWN GRAVELLY SAND, TRACE SILT (FILL)
5	11	SP	REDDISH BROWN MEDIUM SAND, LITTLE GRAVEL, TRACE SILT (SATURATED)
10	25	PT	BLACK ORGANIC CLAYEY PEAT, TRACE SILT GRADING SANDY
15			

BORING COMPLETED TO A DEPTH OF 12 FEET ON 11/29/84

WATER ENCOUNTERED AT A DEPTH OF 4.80 FEET BELOW GROUND SURFACE ON 12/2/84



LOG OF BORINGS AND MONITORING WELL DETAILS

Dames & Moore

MAJOR DIVISIONS			GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SAND (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

UNIFIED SOIL CLASSIFICATION SYSTEM

DAMES & MOORE

FIGURE 4

AMERADA HESS (PORT READING) CORPORATION

PHONE: (908) 750-6000
FAX: (908) 750-7798

1 Hess Plaza
Woodbridge, NJ 07095-0961

DPW/96/025
October 31, 1996

CERTIFIED MAIL P-303-736-250
RETURN RECEIPT REQUESTED

Mr. Bret J. Reburn
NEW JERSEY DEPARTMENT of ENVIRONMENTAL PROTECTION
Division of Enforcement Field Operations
Central Bureau of Water & Hazardous Waste Enforcement
CN-407
Trenton, New Jersey 08625-0407

Dear Mr. Reburn:

Enclosed are the records you requested during your site inspection of the Port Reading Refinery's No. 1 Landfarm quarterly groundwater sampling event. The enclosed records submitted are:

1. Well certification logs for BG-2, L1-1, L1-2, L1-3 & L1-4.

2. Well field sampling log for 10/16/96 sampling of the No. 1 Landfarm groundwater wells.

3. Chain of custody copies for the wells sampled on 10/16/96 (BG-2, L1-1, L1-2, L1-3 & L1-4).

Should you have any questions concerning the enclosed information or have any additional requests, please contact me at (908) 750-7734.

Very truly yours,

D P Wilson

D. P. Wilson
Environmental Specialist
License N-4

DPW:em
cc: R. T. Ehrlich
P. J. Barba, Jr.
J. W. McNeil JWM
T. Whittaker

GROUND WATER
MONITORING WELL CERTIFICATION - FORM A - AS-BUILT CERTIFICATION
(One form must be completed for each well)

ame of Permittee: AMERADA HESS
ame of Facility: PORT READING REFINERY
ocation: STATE STREET, PORT READING N.J.

L1-1

JPDES Permit No: NJ

ENGINEER'S CERTIFICATION

ell Permit Number (As assigned by NJDEP's Water
llocation Section (609-984-6831):
This number must be permanently affixed to the
well casing. 26-80868-

Owner's Well Number (As shown on the application or plans): LF BG1
Well Completion Date: 10-19-85
Distance from Top of Casing (cap off) to ground surface (one-hundredth of a foot): .75
Total Depth of Well (one-tenth of a foot): 15.0
Depth to Top of Screen From Top of Casing (one-tenth of a foot): 5.0
Screen Length (feet): 10.0
Screen or Slot Size: 0.020 IN
Screen Material: PVC
Casing Material: (PVC, Steel or Other-Specify): 4.0
Casing Diameter(Inches): 4.0
Static Water Level From Top of Casing at The Time of Certification (one-hundredth of a foot): 6.90
Yield (Gallons per Minute): 2.5
Length of time Well Pumped or Bailed: 3 Hours 0 Minutes
Lithologic Log: ATTACH ON BACK

AUTHENTICATION:

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitted false information including the possibility of fine and imprisonment.

Moustafa A. Gouda
Professional Engineer's Signature

MOUSTAFA A. GOUDA
Professional Engineer's Name
(Please type or print)

SEAL

PE No. GE 20848
Professional Engineer's License #

GROUND WATER

MONITORING WELL CERTIFICATION - FORM A - AS-BUILT CERTIFICATION

(One form must be completed for each well)

Name of Permittee: AMERADA HESS

Name of Facility: PORT READING REFINERY

Location: STATE STREET, PORT READING N.J.

NJPDES Permit No: NJ

ENGINEER'S CERTIFICATION

Well Permit Number (As assigned by NJDEP's Water Allocation Section (609-984-6831): This number must be permanently affixed to the well casing. 26-8068 -

Owner's Well Number (As shown on the application or plans): LF BG1

Well Completion Date: 10-19-85

Distance from Top of Casing (cap off) to ground surface (one-hundredth of a foot): .75

Total Depth of Well (one-tenth of a foot): 15.0

Depth to Top of Screen From Top of Casing (one-tenth of a foot): 5.0

Screen Length (feet): 10.0

Screen or Slot Size: 0.020 IN.

Screen Material: PVC

Casing Material: (PVC, Steel or Other-Specify): 4.0

Casing Diameter (Inches): 4.0

Static Water Level From Top of Casing at The Time of Certification (one-hundredth of a foot): 6.90

Yield (Gallons per Minute): 2.5

Length of time Well Pumped or Bailed: 3 Hours 0 Minutes

Lithologic Log: ATTACH ON BACK

AUTHENTICATION:

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitted false information including the possibility of fine and imprisonment.

Moustafa A. Gouda

Professional Engineer's Signature

MOUSTAFA A. GOUDA

Professional Engineer's Name (Please type or print)

SEAL

PE No. GE 20848

Professional Engineer's License #

THIS FORM MUST BE COMPLETED BY THE PERMITTEE OR HIS/HER AGENT

GROUND WATER MONITORING WELL CERTIFICATION - FORM B - LOCATION CERTIFICATION

Name of Permittee: AMERADA HESS
Name of Facility: PORT READING REFINERY
Location: STATE STREET, PORT READING NJ

NJPDES Number: NJ

LAND SURVEYOR'S CERTIFICATION

Well Permit Number (As assigned by NJDEP's Water Allocation Section, 609-984-6831): This number must be permanently affixed to the well casing. 26 - 8068 _ _ - _

Longitude (one-tenth of a second): West 74-14-30
Latitude (one-tenth of a second): North 40-33-40
Elevation of Top of Casing (cap off) (one-hundredth of a foot): 13.55
Owners Well Number (As shown on the application or plans): LFBG 1

AUTHENTICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Vincent Schulte
PROFESSIONAL LAND SURVEYOR'S SIGNATURE

Vincent Schulte
PROFESSIONAL LAND SURVEYOR'S NAME
(Please print or type)

SEAL

7071
PROFESSIONAL LAND SURVEYOR'S LICENSE #

The Department reserves the right in cases of violation of permit specified ground water limits or Ground Water Quality Standards (N.J.A.C. 7:9-6.1 et seq.) to require that wells be resurveyed to an accuracy of one-hundredth of a second latitude and longitude. This shall not be considered to require a major modification of the NJPDES permit.

Form DWR-138
11/80

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES

PERMIT NO. #26-8068

APPLICATION NO. ________

COUNTY MIDDLESEX

WELL RECORD

1. OWNER AMERADA HESS ADDRESS PORT READING NJ
   Owner's Well No. FBG 1 SURFACE ELEVATION 12.8 Feet (Above mean sea level)
2. LOCATION NORTH LAND FARM
3. DATE COMPLETED 10-18-85 DRILLER Barry Woodington
4. DIAMETER: Top 4 inches Bottom 4 inches TOTAL DEPTH 15 Feet
5. CASING: Type PVC Diameter 4 Inches Length 5 Feet
6. SCREEN: Type PVC Size of Opening .020" Diameter 4 Inches Length 10 Feet
   Range in Depth { Top — Feet, Bottom — Feet } Geologic Formation RARITAN-MAGOTHY
   Tail Piece: Diameter ________ Inches Length ________ Feet
7. WELL FLOWS NATURALLY — Gallons per minute at ________ Feet above surface
   Water rises to ________ Feet above surface
8. RECORD OF TEST: Date 10-19-85 Yield 2.5 Gallons per minute
   Static water level before pumping 6.9 Feet below surface
   Pumping level 6.9 feet below surface after 2 hours pumping
   Drawdown ________ Feet Specific Capacity ________ Gals. per min. per ft. of drawdown
   How pumped SHALLOW WELL JET How measured VOLUMETRICALLY
   Observed effect on nearby wells ________
9. PERMANENT PUMPING EQUIPMENT: NO
   Type ________ Mfrs. Name ________
   Capacity ________ G.P.M. How Driven ________ H.P. ________ R.P.M. ________
   Depth of Pump in well ________ Feet Depth of Footpiece in well ________ Feet
   Depth of Air Line in well ________ Feet Type of Meter on Pump ________ Size ________ Inches
10. USED FOR GROUND WATER MONITORING AMOUNT { Average ________ Gallons Daily, Maximum ________ Gallons Daily }
11. QUALITY OF WATER N/A Sample: Yes ____ No ____
    Taste ________ Odor ________ Color ________ Temp. ________ °F.
12. LOG SEE ATTACHED Are samples available? YES
    (Give details on back of sheet or on separate sheet. If electric log was made, please furnish copy.)
13. SOURCE OF DATA DRILLERS OBSERVATIONS
14. DATA OBTAINED BY Joe Tabasco Date 11-26-85

(NOTE: Use other side of this sheet for additional information such as log of materials penetrated, analysis of the water, sketch map, sketch of special casing arrangements, etc.)

GROUND WATER
MONITORING WELL CERTIFICATION - FORM A - AS-BUILT CERTIFICATION
(One form must be completed for each well)

Name of Permittee: AMERADA HESS
Name of Facility: PORT READING REFINERY
Location: STATE STREET, PORT READING N.J.

NJPDES Permit No: NJ

ENGINEER'S CERTIFICATION

Well Permit Number (As assigned by NJDEP's Water Allocation Section (609-984-6831): This number must be permanently affixed to the well casing. L1-2 26-8065-

Owner's Well Number (As shown on the application or plans): LF1 DG1
Well Completion Date: 10-18-85
Distance from Top of Casing (cap off) to ground surface (one-hundredth of a foot): 1.17
Total Depth of Well (one-tenth of a foot): 14.0
Depth to Top of Screen From Top of Casing (one-tenth of a foot): 4.0
Screen Length (feet): 10.0
Screen or Slot Size: 0.020 IN
Screen Material: PVC
Casing Material: (PVC, Steel or Other-Specify): PVC
Casing Diameter (Inches): 4.0
Static Water Level From Top of Casing at The Time of Certification (one-hundredth of a foot): 6.4
Yield (Gallons per Minute): 3.3
Length of time Well Pumped or Bailed: 2 Hours 30 Minutes
Lithologic Log: ATTACH ON BACK

AUTHENTICATION:

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitted false information including the possibility of fine and imprisonment.

Moustafa A Gouda
Professional Engineer's Signature

MOUSTAFA A. GOUDA
Professional Engineer's Name
(Please type or print)

SEAL

PE No GE 20848
Professional Engineer's License #

LIPPINCOTT ENGINEERING ASSOCIATES
501 BURLINGTON AVENUE DELANCO, N.J. 08075

PROJECT NO. 3929.A1
DATE 10/16/85

SHEET 2 OF 7
SURFACE ELEV 10.0

PROJECT WELL INSTALLATION/NO. 1 LAND FARM
CLIENT AMERADA HESS

LOCATION PORT READING REFINERY
LOG OF BORING NO. LF-1 DG-1
Permit No. 26-8065

DEPTH	SAMPLE NUMBER	TYPE*	SAMPLE DEPTH	NUMBER OF BLOWS PER 6"	CLASSIFICATION OF MATERIALS BASED ON SAMPLES RECOVERED PLUS OBSERVATION OF MATERIAL RETURNED BETWEEN SAMPLES	MOISTURE CONTENT
0	S-1	A	0/2	6-12-12-14	Brown coarse-fine SAND, little gravel, little silt.	
5	S-2	A	4/6	4-7-10-11	Brown coarse-fine GRAVEL & coarse-fine SHALE, trace silt.	
10	S-3	A	9/11	7-8-6-3	Light brown, same.	
	S-4	A	13/15	2-2-1-1	Dark brown organic SILTY CLAY.	
15					EOB 15'-0"	

R-106 Rev.2/7

GROUND WATER DATA

DEPTH	HOUR	DATE
7'-3"		10/16/85
6'-11"		10/18/85
6'-2"		10/19/85

* A. STANDARD PENETRATION TEST (ASTM-D 1586)
B. STANDARD THIN-WALLED 3" TUBE (ASTM-D 1587)
C. CORE DRILLING

DRILLER B. WOODINGTON HELPER T. LIPPINCOTT

THIS FORM MUST BE COMPLETED BY THE PERMITTEE OR HIS/HER AGENT

GROUND WATER MONITORING WELL CERTIFICATION - FORM B - LOCATION CERTIFICATIO

Name of Permittee: AMERADA HESS
Name of Facility: PORT READING REFINERY
Location: STATE STREET, PORT READING N.J

NJPDES Number: NJ

LAND SURVEYOR'S CERTIFICATION

Well Permit Number (As assigned by NJDEP's Water Allocation Section, 609-984-6831): This number must be permanently affixed to the well casing. 26-80655 - _

Longitude (one-tenth of a second): West 74-14-29
Latitude (one-tenth of a second): North 40-33-44
Elevation of Top of Casing (cap off) (one-hundredth of a foot): 11.17
Owners Well Number (As shown on the application or plans): LF1 DG1

AUTHENTICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Vincent Schultz
PROFESSIONAL LAND SURVEYOR'S SIGNATURE

Vincent Schulte
PROFESSIONAL LAND SURVEYOR'S NAME
(Please print or type)

SEAL

7071
PROFESSIONAL LAND SURVEYOR'S LICENSE #

The Department reserves the right in cases of violation of permit specified ground water limits or Ground Water Quality Standards (N.J.A.C. 7:9-6.1 et seq.) to require that wells b resurveyed to an accuracy of one-hundredth of a second latitude and longitude. This shall not be considered to require a major modification of the NJPDES permit.

Form DWR-138
11/80

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES

PERMIT NO. #26-8065

APPLICATION NO. ____

COUNTY MIDDLESEX

WELL RECORD

1. OWNER AMERADA HESS ADDRESS PORT READING, NJ
   Owner's Well No. DG1 (LF-1) SURFACE ELEVATION 10.0 Feet (Above mean sea level)
2. LOCATION NORTH LAND FILL
3. DATE COMPLETED 10-18-85 DRILLER JOHN SNYDER
4. DIAMETER: Top 4 inches Bottom 4 inches TOTAL DEPTH 14.0 Feet
5. CASING: Type PVC Diameter 4 Inches Length 4.0 Feet
6. SCREEN: Type PVC Size of Opening .020" Diameter 4 Inches Length 10 Feet
   Range in Depth: Top ____ Feet, Bottom ____ Feet
   Geologic Formation RARITAN - MAGOTHY
   Tail Piece: Diameter ____ Inches Length ____ Feet
7. WELL FLOWS NATURALLY — Gallons per minute at ____ Feet above surface
   Water rises to ____ Feet above surface
8. RECORD OF TEST: Date 11-11-85 Yield 3.3 Gallons per minute
   Static water level before pumping 5'9" Feet below surface
   Pumping level 14-0 feet below surface after 2½ hours pumping
   Drawdown ____ Feet Specific Capacity ____ Gals. per min. per ft. of drawdown
   How pumped SHALLOW WELL JET How measured VOLUMETRICALLY
   Observed effect on nearby wells ____
9. PERMANENT PUMPING EQUIPMENT: NO
   Type ____ Mfrs. Name ____
   Capacity ____ G.P.M. How Driven ____ H.P. ____ R.P.M. ____
   Depth of Pump in well ____ Feet Depth of Footpiece in well ____ Feet
   Depth of Air Line in well ____ Feet Type of Meter on Pump ____ Size ____ Inches
10. USED FOR GROUND WATER MONITORING AMOUNT: Average ____ Gallons Daily, Maximum ____ Gallons Daily
11. QUALITY OF WATER N/A Sample: Yes ____ No ____
    Taste ____ Odor ____ Color ____ Temp. ____ °F.
12. LOG SEE ATTACHED Are samples available? ____
    (Give details on back of sheet or on separate sheet. If electric log was made, please furnish copy.)
13. SOURCE OF DATA DRILLER'S OBSERVATIONS
14. DATA OBTAINED BY Joe Tabasco Date 11-26-85

(NOTE: Use other side of this sheet for additional information such as log of materials penetrated, analysis of the water, sketch map, sketch of special casing arrangements, etc.)

GROUND WATER

MONITORING WELL CERTIFICATION - FORM A - AS-BUILT CERTIFICATION

(One form must be completed for each well)

Name of Permittee: AMERADA HESS

Name of Facility: PORT READING REFINERY

Location: STATE STREET, PORT READING N.J.

NJPDES Permit No: NJ

ENGINEER'S CERTIFICATION

Well Permit Number (As assigned by NJDEP's Water Allocation Section (609-984-6831):
This number must be permanently affixed to the well casing. 26-80666-

Owner's Well Number (As shown on the application or plans): D62 L1-3

Well Completion Date: 10-19-85

Distance from Top of Casing (cap off) to ground surface (one-hundredth of a foot): 1.40

Total Depth of Well (one-tenth of a foot): 9.4

Depth to Top of Screen From Top of Casing (one-tenth of a foot): 4.4

Screen Length (feet): 5.0

Screen or Slot Size: 0.020 IN

Screen Material: PVC

Casing Material: (PVC, Steel or Other-Specify): PVC

Casing Diameter (Inches): 4.0

Static Water Level From Top of Casing at The Time of Certification (one-hundredth of a foot): 5.2

Yield (Gallons per Minute): 1.2

Length of time Well Pumped or Bailed: 2 Hours 30 Minutes

Lithologic Log: ATTACH ON BACK

AUTHENTICATION:

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitted false information including the possibility of fine and imprisonment.

Moustafa A Gouda

Professional Engineer's Signature

MOUSTAFA A. GOUDA

Professional Engineer's Name
(Please type or print)

PE No GE20848

Professional Engineer's License #

SEAL

THIS FORM MUST BE COMPLETED BY THE PERMITTEE OR HIS/HER AGENT

GROUND WATER MONITORING WELL CERTIFICATION - FORM B - LOCATION CERTIFICATION

Name of Permittee: AMERADA HESS
Name of Facility: PORT READING REFINERY
Location: STATE STREET, PORT READING N.J.

NJPDES Number: NJ

LAND SURVEYOR'S CERTIFICATION

Well Permit Number (As assigned by NJDEP's Water Allocation Section, 609-984-6831): This number must be permanently affixed to the well casing. 26-8066 -

Longitude (one-tenth of a second): West 74-14-26
Latitude (one-tenth of a second): North 40-33-44
Elevation of Top of Casing (cap off) (one-hundredth of a foot): 11.70
Owners Well Number (As shown on the application or plans): DG2

AUTHENTICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Vincent Schulte
PROFESSIONAL LAND SURVEYOR'S SIGNATURE

Vincent Schulte
PROFESSIONAL LAND SURVEYOR'S NAME
(Please print or type)

SEAL

7071
PROFESSIONAL LAND SURVEYOR'S LICENSE #

The Department reserves the right in cases of violation of permit specified ground water limits or Ground Water Quality Standards (N.J.A.C. 7:9-6.1 et seq.) to require that wells be resurveyed to an accuracy of one-hundredth of a second latitude and longitude. This shall not be considered to require a major modification of the NJPDES permit.

Form DWR- 138
11/80

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES

PERMIT NO. 26- 8066

APPLICATION NO. ______

COUNTY MIDDLESEX

WELL RECORD

1. OWNER AMERADA HESS ADDRESS PORT READING, NJ
   Owner's Well No. DG-2 SURFACE ELEVATION 10.3 Feet (Above mean sea level)
2. LOCATION NORTH LAND FILL
3. DATE COMPLETED 10-19-85 DRILLER BARRIE WOODINGTON
4. DIAMETER: Top 4 inches Bottom 4 inches TOTAL DEPTH 9.4 Feet
5. CASING: Type PVC Diameter 4 Inches Length 9.4 Feet
6. SCREEN: Type PVC Size of Opening .020" Diameter 4 Inches Length 5.0 Feet
   Range in Depth { Top ______ Feet / Bottom ______ Feet } Geologic Formation RARITAN-MAGOTHY
   Tail Piece: Diameter ______ Inches Length ______ Feet
7. WELL FLOWS NATURALLY — Gallons per minute at ______ Feet above surface
   Water rises to ______ Feet above surface
8. RECORD OF TEST: Date 11-11-85 Yield 1.2 Gallons per minute
   Static water level before pumping 6' 9" Feet below surface
   Pumping level 9.4 feet below surface after 2 1/2 hours pumping
   Drawdown ______ Feet Specific Capacity ______ Gals. per min. per ft. of drawdown
   How pumped SHALLOW WELL JET How measured VOLUMETRICALLY
   Observed effect on nearby wells ______
9. PERMANENT PUMPING EQUIPMENT: NO
   Type ______ Mfrs. Name ______
   Capacity ______ G.P.M. How Driven ______ H.P. ______ R.P.M. ______
   Depth of Pump in well ______ Feet Depth of Footpiece in well ______ Feet
   Depth of Air Line in well ______ Feet Type of Meter on Pump ______ Size ______ Inches
10. USED FOR GROUND WATER MONITORING AMOUNT { Average ______ Gallons Daily / Maximum ______ Gallons Daily }
11. QUALITY OF WATER N/A Sample: Yes ______ No ______
    Taste ______ Odor ______ Color ______ Temp. ______ °F.
12. LOG SEE ATTACHED Are samples available? YES
    (Give details on back of sheet or on separate sheet. If electric log was made, please furnish copy.)
13. SOURCE OF DATA DRILLER'S OBSERVATIONS
14. DATA OBTAINED BY Joe Tabasco Date 11-26-85

(NOTE: Use other side of this sheet for additional information such as log of materials penetrated, analysis of the water, sketch map, sketch of special casing arrangements, etc.)

THIS FORM MUST BE COMPLETED BY THE PERMITTEE OR HIS/HER AGENT

GROUND WATER
MONITORING WELL CERTIFICATION - FORM A - AS-BUILT CERTIFICATION
(One form must be completed for each well)

Name of Permittee: AMERADA HESS
Name of Facility: PORT READING REFINERY
Location: STATE STREET, PORT READING N.J.

NJPDES Permit No: NJ

ENGINEER'S CERTIFICATION

Well Permit Number (As assigned by NJDEP's Water Allocation Section (609-984-6831): This number must be permanently affixed to the well casing.	26-80671--
Owner's Well Number (As shown on the application or plans):	DG3
Well Completion Date:	10-18-85
Distance from Top of Casing (cap off) to ground surface (one-hundredth of a foot):	2.05
Total Depth of Well (one-tenth of a foot):	9.0
Depth to Top of Screen From Top of Casing (one-tenth of a foot):	4.0
Screen Length (feet):	5.0
Screen or Slot Size:	0.020 IN
Screen Material:	PVC
Casing Material: (PVC, Steel or Other-Specify):	PVC
Casing Diameter (Inches):	4.0
Static Water Level From Top of Casing at The Time of Certification (one-hundredth of a foot):	4.6
Yield (Gallons per Minute):	1.5
Length of time Well Pumped or Bailed:	3 Hours 0 Minutes
Lithologic Log:	ATTACH ON BACK

L1-4

AUTHENTICATION:
I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitted false information including the possibility of fine and imprisonment.

Moustafa A. Gouda
Professional Engineer's Signature

MOUSTAFA A. GOUDA
Professional Engineer's Name
(Please type or print)

SEAL

PE No GE20848
Professional Engineer's License #

LIPPINCOTT ENGINEERING ASSOCIATES
501 BURLINGTON AVENUE DELANCO, N.J. 08075

PROJECT NO. 3929.A1
DATE 10/17/85

SHEET 4 OF 7
SURFACE ELEV 11.1

PROJECT WELL INSTALLATION/NO. 1 LAND FARM CLIENT AMERADA HESS

LOCATION PORT READING REFINERY LOG OF BORING NO. LF-1 DG-3

Permit No. 26-8067

DEPTH	SAMPLE NUMBER	TYPE*	SAMPLE DEPTH	NUMBER OF BLOWS PER 6"	CLASSIFICATION OF MATERIALS BASED ON SAMPLES RECOVERED PLUS OBSERVATION OF MATERIAL RETURNED BETWEEN SAMPLES	MOISTURE CONTENT
0	S-1	A	0/2	5-8-9-12	Brown coarse-fine SAND, little gravel, little silt.	
5	S-2	A	4/6	5-4-4-5	Brown coarse-fine SAND, some silt, little gravel.	
10	S-3	A	9/11	1-2-1-1	Dark brown organic SILTY CLAY.	
					EOB 11'-0"	

R-106 Rev.2/7

GROUND WATER DATA

DEPTH	HOUR	DATE
7'-6"		10/17/85

* A. STANDARD PENETRATION TEST (ASTM-D 1586)
B. STANDARD THIN-WALLED 3" TUBE (ASTM-D 1587)
C. CORE DRILLING

DRILLER J. SNYDER HELPER E. DORON

THIS FORM MUST BE COMPLETED BY THE PERMITTEE OR HIS/HER AGENT

GROUND WATER MONITORING WELL CERTIFICATION - FORM B - LOCATION CERTIFICATION

Name of Permittee: AMERADA HESS
Name of Facility: PORT READING REFINERY
Location: STATE STREET, PORT READING N.J.

NJPDES Number: NJ

LAND SURVEYOR'S CERTIFICATION

Well Permit Number (As assigned by NJDEP's Water Allocation Section, 609-984-6831): This number must be permanently affixed to the well casing. 26-80067-

Longitude (one-tenth of a second): West 74-14-25
Latitude (one-tenth of a second): North 40-33-43
Elevation of Top of Casing (cap off) (one-hundredth of a foot): 13.15
Owners Well Number (As shown on the application or plans): DG3

AUTHENTICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Vincent Schulte
PROFESSIONAL LAND SURVEYOR'S SIGNATURE

Vincent Schulte
PROFESSIONAL LAND SURVEYOR'S NAME
(Please print or type)

SEAL

7071
PROFESSIONAL LAND SURVEYOR'S LICENSE #

The Department reserves the right in cases of violation of permit specified ground water limits or Ground Water Quality Standards (N.J.A.C. 7:9-6.1 et seq.) to require that wells be resurveyed to an accuracy of one-hundredth of a second latitude and longitude. This shall not be considered to require a major modification of the NJPDES permit.

Form DWR-138
1/80

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES

PERMIT NO. # 26-5667

APPLICATION NO. ______

COUNTY MIDDLESEX

WELL RECORD

1. OWNER AMERADA HESS ADDRESS PORT READING NJ
   Owner's Well No. DG 3 SURFACE ELEVATION 11.1 Feet (Above mean sea level)
2. LOCATION NORTH LAND FILL
3. DATE COMPLETED 10-18-85 DRILLER JOHN SNYDER
4. DIAMETER: Top 4 inches Bottom 4 inches TOTAL DEPTH 9.0 Feet
5. CASING: Type PVC Diameter 4 Inches Length 4.0 Feet
6. SCREEN: Type PVC Size of Opening .020" Diameter 4 Inches Length 5.0 Feet
   Range in Depth { Top ______ Feet / Bottom ______ Feet } Geologic Formation RARITON-MAGOTHY
   Tail Piece: Diameter ______ Inches Length ______ Feet
7. WELL FLOWS NATURALLY — Gallons per minute at ______ Feet above surface
   Water rises to ______ Feet above surface
8. RECORD OF TEST: Date 11-11-85 Yield 1.5 Gallons per minute
   Static water level before pumping 7'8" Feet below surface
   Pumping level 9.0' feet below surface after 3 hours pumping
   Drawdown ______ Feet Specific Capacity ______ Gals. per min. per ft. of drawdown
   How pumped SHALLOW WELL JET How measured VOLUMETRICALLY
   Observed effect on nearby wells ______
9. PERMANENT PUMPING EQUIPMENT: NO
   Type ______ Mfrs. Name ______
   Capacity ______ G.P.M. How Driven ______ H.P. ______ R.P.M. ______
   Depth of Pump in well ______ Feet Depth of Footpiece in well ______ Feet
   Depth of Air Line in well ______ Feet Type of Meter on Pump ______ Size ______ Inches
10. USED FOR GROUND WATER MONITORING AMOUNT { Average ______ Gallons Daily / Maximum ______ Gallons Daily }
11. QUALITY OF WATER N/A Sample: Yes ______ No ______
    Taste ______ Odor ______ Color ______ Temp. ______ °F.
12. LOG SEE ATTACHED Are samples available? YES
    (Give details on back of sheet or on separate sheet. If electric log was made, please furnish copy.)
13. SOURCE OF DATA DRILLER'S OBSERVATIONS
14. DATA OBTAINED BY Joe Tabasco Date 11-26-85

(NOTE: Use other side of this sheet for additional information such as log of materials penetrated, analysis of the water, sketch map, sketch of special casing arrangements, etc.)

GROUND WATER

MONITORING WELL CERTIFICATION - FORM A - AS-BUILT CERTIFICATION

(One form must be completed for each well)

ame of Permittee: AMERADA HESS

ame of Facility: PORT READING REFINERY

ocation: STATE STREET, PORT READING N.J.

JPDES Permit No: NJ

NGINEER'S CERTIFICATION

Well Permit Number (As assigned by NJDEP's Water
llocation Section (609-984-6831):
This number must be permanently affixed to the
well casing. 26-8132-_

wner's Well Number (As shown on the application or plans): BG2

Well Completion Date: 10-18-85

istance from Top of Casing (cap off) to ground surface (one-hundredth of a foot): 1.70

Total Depth of Well (one-tenth of a foot): 9.2

Depth to Top of Screen From Top of Casing (one-tenth of a foot): 4.2

Screen Length (feet): 5.0

Screen or Slot Size: 0.020 IN

Screen Material: PVC

Casing Material: (PVC, Steel or Other-Specify): PVC 4.0 BG-2

Casing Diameter(Inches): 4.0

Static Water Level From Top of Casing at The Time of Certification (one-hundredth of a foot): 2.80

Yield (Gallons per Minute): 0.5

Length of time Well Pumped or Bailed: 5 Hours 0 Minutes

Lithologic Log: ATTACH ON BACK

AUTHENTICATION:

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitted false information including the possibility of fine and imprisonment.

Moustafa A Gouda

Professional Engineer's Signature

MOUSTAFA A. GOUDA

Professional Engineer's Name
(Please type or print)

SEAL

PE No. GE 20848

Professional Engineer's License #

LIPPINCOTT ENGINEERING ASSOCIATES
501 BURLINGTON AVENUE DELANCO, N.J. 08075

PROJECT NO. 3929.A1
DATE 10/18/85

SHEET 5 OF 7
SURFACE ELEV 9.6

PROJECT WELL INSTALLATION/NO. 1 LAND FARM
CLIENT AMERADA HESS

LOCATION PORT READING REFINERY
LOG OF BORING NO. BG-2

Permit No. 26-8132

DEPTH	SAMPLE NUMBER	TYPE*	SAMPLE DEPTH	NUMBER OF BLOWS PER 6"	CLASSIFICATION OF MATERIALS BASED ON SAMPLES RECOVERED PLUS OBSERVATION OF MATERIAL RETURNED BETWEEN SAMPLES	MOISTURE CONTENT
0	S-1	A	0/ 2	5-7-15-21	Brown coarse-fine SAND, some silt, little gravel.	
5	S-2	A	4/ 6	3-7-7-10	Same.	
10	S-3	A	9/ 11	2-2-1-2	Dark brown PEAT.	
					EOB 11'-0"	

R-106 Rev.2/7

GROUND WATER DATA

DEPTH	HOUR	DATE
3'-0"		10/19/85

* A. STANDARD PENETRATION TEST (ASTM-D 1586)
B. STANDARD THIN-WALLED 3" TUBE (ASTM-D 1587)
C. CORE DRILLING

DRILLER J. SNYDER HELPER E. DORON

THIS FORM MUST BE COMPLETED BY THE PERMITTEE OR HIS/HER AGENT

GROUND WATER MONITORING WELL CERTIFICATION - FORM B - LOCATION CERTIFICATION

Name of Permittee: AMERADA HESS
Name of Facility: PORT READING REFINERY
Location: STATE STREET, PORT READING N.J.

NJPDES Number: NJ

LAND SURVEYOR'S CERTIFICATION

Well Permit Number (As assigned by NJDEP's Water Allocation Section, 609-984-6831): This number must be permanently affixed to the well casing. 26-8132 -

Longitude (one-tenth of a second): West 74-14-32
Latitude (one-tenth of a second): North 40-33-43
Elevation of Top of Casing (cap off) (one-hundredth of a foot): 11.32
Owners Well Number (As shown on the application or plans): BG2

AUTHENTICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Vincent Schulte
PROFESSIONAL LAND SURVEYOR'S SIGNATURE

Vincent Schulte
PROFESSIONAL LAND SURVEYOR'S NAME
(Please print or type)

SEAL

7071
PROFESSIONAL LAND SURVEYOR'S LICENSE #

The Department reserves the right in cases of violation of permit specified ground water limits or Ground Water Quality Standards (N.J.A.C. 7:9-6.1 et seq.) to require that wells b resurveyed to an accuracy of one-hundredth of a second latitude and longitude. This shall not be considered to require a major modification of the NJPDES permit.

Form DWR- 138
11/80

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES

PERMIT NO. #26-8132

APPLICATION NO. ______

COUNTY MIDDLESEX

WELL RECORD

1. OWNER AMERADA HESS ADDRESS PORT READING, NJ
   Owner's Well No. BG-2 SURFACE ELEVATION 9.6 Feet (Above mean sea level)
2. LOCATION NORTH LAND FARM
3. DATE COMPLETED 10-18-85 DRILLER BARRIE WOODINGTON
4. DIAMETER: Top 4 inches Bottom 4 inches TOTAL DEPTH 9.7 Feet
5. CASING: Type PVC Diameter 4 Inches Length 4.7 Feet
6. SCREEN: Type PVC Size of Opening .020" Diameter 4 Inches Length 5.0 Feet
   Range in Depth { Top ______ Feet / Bottom ______ Feet } Geologic Formation RARITAN-MAGOTHY
   Tail Piece: Diameter ______ Inches Length ______ Feet
7. WELL FLOWS NATURALLY — Gallons per minute at ______ Feet above surface
   Water rises to ______ Feet above surface
8. RECORD OF TEST: Date 11-14-85 Yield 0.5 Gallons per minute
   Static water level before pumping 3.3 Feet below surface
   Pumping level 9.0 feet below surface after 5 hours pumping
   Drawdown – Feet Specific Capacity – Gals. per min. per ft. of drawdown
   How pumped SHALLOW WELL JET How measured VOLUMETRICALLY
   Observed effect on nearby wells ______
9. PERMANENT PUMPING EQUIPMENT: NO
   Type ______ Mfrs. Name ______
   Capacity ______ G.P.M. How Driven ______ H.P. ______ R.P.M. ______
   Depth of Pump in well ______ Feet Depth of Footpiece in well ______ Feet
   Depth of Air Line in well ______ Feet Type of Meter on Pump ______ Size ______ Inches
10. USED FOR GROUND WATER MONITORING AMOUNT { Average ______ Gallons Daily / Maximum ______ Gallons Daily }
11. QUALITY OF WATER N/A Sample: Yes ____ No ____
    Taste ______ Odor ______ Color ______ Temp. ______ °F.
12. LOG SEE ATTACHED Are samples available? YES
    (Give details on back of sheet or on separate sheet. If electric log was made, please furnish copy.)
13. SOURCE OF DATA DRILLERS OBSERVATIONS
14. DATA OBTAINED BY Joe Tabasco Date 11-26-85

(NOTE: Use other side of this sheet for additional information such as log of materials penetrated, analysis of the water, sketch map, sketch of special casing arrangements, etc.)

CORE LAB

CORE LABORATORIES, INC.

No. 76613

CHAIN OF CUSTODY RECORD

CUSTOMER INFORMATION	PROJECT INFORMATION
COMPANY: Amerada Hess Corp.	PROJECT NAME/NUMBER: #1 LFM - leachate
SEND REPORT TO: Dave Wilson	BILLING INFORMATION
ADDRESS: Pt. Reading Refinery, 750 Cliff Rd., Pt. Reading, NJ	BILL TO:
	ADDRESS:
PHONE:	PHONE:
FAX:	FAX: PO NO.:

LAB JOB NO.:

ANALYSIS / METHOD REQUEST: 8240/PRW/VOA's (40 ml) · 8270/PRW/BNA's (1L amber) · 601/7000 PRW metals (1L pl) · Temp

SAMPLE NO.	SAMPLE DESCRIPTION	SAMPLE DATE	SAMPLE TIME	SAMPLE MATRIX	CONTAINER	PRESERV.	NUMBER OF CONTAINERS	8240/PRW/VOA's	8270/PRW/BNA's	601/7000 PRW metals	Temp	REMARKS / PRECAUTIONS
BRJ400		101696	1805	H2O	–	–	7	3	2	1	1	
BRJ402	FB	101696	0936	↓	↓	↓	5	2	2	1		
BRJ403	TB	101696	0936	↓	↓	↓	2	2				
	SEAL # 05732											

SAMPLER:

SHIPMENT METHOD:

AIRBILL NO.:

REQUIRED TURNAROUND:* [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [x] ROUTINE OTHER

1. RELINQUISHED BY:	DATE	2. RELINQUISHED BY:	DATE	3. RELINQUISHED BY:	DATE
SIGNATURE: [signature]		SIGNATURE:		SIGNATURE:	
PRINTED NAME/COMPANY:	TIME	PRINTED NAME/COMPANY:	TIME	PRINTED NAME/COMPANY:	TIME
1. RECEIVED BY:	DATE	2. RECEIVED BY:	DATE	3. RECEIVED BY:	DATE
SIGNATURE:		SIGNATURE:		SIGNATURE:	
PRINTED NAME/COMPANY:	TIME	PRINTED NAME/COMPANY:	TIME	PRINTED NAME/COMPANY:	TIME

* RUSH TURNAROUND MAY REQUIRE SURCHARGE

- [ ] Anaheim, CA 1250 E. Gene Autry Way Anaheim, CA 92805 (714) 937-1094 Fax (714) 937-1170
- [ ] Aurora, CO 10703 E. Bethany Drive Aurora, CO 80014 (303) 751-1780 Fax (303) 751-1784
- [ ] Casper, WY 420 W. First Street Casper, WY 82601 (307) 235-5741 Fax (307) 266-1676
- [ ] Corpus Christi, TX 1733 N. Padre Island Drive Corpus Christi, TX 78408 (512) 289-2673 Fax (512) 289-2471
- [x] Edison, NJ 284 Raritan Center Parkway Edison, NJ 08837 (908) 225-6700 Fax (908) 225-6777
- [ ] Houston, TX (Env) 8310 Rothway Drive Houston, TX 77040 (713) 690-4444 Fax (713) 690-5646
- [ ] Houston, TX (Pet) 8210 Mosley Road Houston, TX 77075 (713) 943-9776 Fax (713) 943-3846
- [ ] Indianapolis, IN 7726 Moller Road Indianapolis, IN 46268 (317) 875-5894 Fax (317) 872-6189
- [ ] Lake Charles, LA 3645 Beglis Parkway Sulphur, LA 70663
- [ ] Long Beach, CA 3700 Cherry Avenue Long Beach, CA 90807
- [ ] Tampa, FL 5460 Beaumont Center Blvd. Tampa, FL 33634
- [ ] Valparaiso, IN 2400 Cumberland Drive Valparaiso, IN 46383

CORELAB ENVIRONMENTAL TESTING SERVICES EDISON, N.J.

CHAIN OF CUSTODY FORM (CC1)

Seal No. ____ CORE Job # ____

Date Sealed ____ By: ____

Company: AMERADA HESS CORPORATION Attn.: DAVE WILSON

Facility/Site: PT. READING REFINERY Phone: ( ) -

Address: 750 CLIFF ROAD, PT. READING, NJ

SAMPLE IDENTIFICATION

Facility: HHCFCRBGMM (Facility/Site Code) (Optional Sample Point Descriptions)

Sample Point: W - FIELDBLANK4 (Source Code (from below)) (Your Sample Point ID (left justify)) 101696 (Start Date (YY/MM/DD)) 0858 (Start Time (2400 hr. clock)) (Elapsed Hours (composite))

Source Codes:

Well ..(W) Outfall ....(O) Bottom Sediment ....(B) Surface Impoundment....(I) Leachate Collection Sys.....(C) Other ....(X)

Soil ...(S) River/Stream..(R) Generation Point ....(G) Treatment Facility ....(T) Lake/Ocean ....(L) Specify ____

SHUTTLE CONTENTS

BOTTLE				ANALYSIS	SAMPLER		LAB
No	Type	Size	Preserv.		Filt. (Y/N)	Observations	Observations
2	VOA	40	HCL	VOLATILES	N		
2	EXT	1000	NONE	625/BN			
1	METP	1000	HNO3	FILTERED METALS			
1	CONU	500	NONE	PH/SCOND			
1	CYAN	500	NaOH	CYAN/MACRO (CHYN)			
1	CONS	500	H2SO4	PHENOLS/MACRO (CHYN			
1	TEMP	40	NONE	TEMPERATURE			
1	METP	1000	HNO3	TOTAL METALS (BPJ211			

CHAIN OF CUSTODY CHRONICLE

1. Shuttle Opened By: (print) ____ Date: ____ Time: ____
Signature: ____ Seal #: ____ Intact: ____

2. I have received these materials in good condition from the above person.
Name: ____ Signature: ____
Date: ____ Time: ____ Remarks: ____

3. I have received these materials in good condition from the above person.
Name: ____ Signature: ____
Date: ____ Time: ____ Remarks: ____

4. Shuttle Sealed By: (print) ____ Date: 101696 Time: 0928
Signature: D Pwh Seal #: 005159 Intact: YES

LAB USE ONLY Opened By: ____ Date: ____ Time: ____

SHUTTLE # ____ TEMP. °C ____ SEAL # ____ COND. ____

CORE LAB
ENVIRONMENTAL TESTING SERVICES

CHAIN OF CUSTODY FORM (CC1)

SAMPLER

EDISON, N.J.

Seal No. ______ CORE Job # ______

Date Sealed ______ By: ______

Company: AMERADA HESS CORPORATION Attn.: DAVE WILSON

Facility/Site: PT. READING REFINERY Phone: ( ) -

Address: 750 CLIFF ROAD. PT. READING. NJ

SAMPLE IDENTIFICATION

Facility: AHCPTPCGNM (Facility/Site Code) (Optional Sample Point Descriptions)

Sample Point: X - TRIPBLANK4 | 101696 | 0858 | -

Source Code (from below) | Your Sample Point ID (left justify) | Start Date (YY/MM/DD) | Start Time (2400 hr. clock) | Elapsed Hours (composite)

Source Codes:
Well ..(W) Outfall.......(O) Bottom Sediment....(B) Surface Impoundment....(I) Leachate Collection Sys.....(C) Other ....(X)
Soil ...(S) River/Stream..(R) Generation Point....(G) Treatment Facility ......(T) Lake/Ocean ....(L) Specify ______

SHUTTLE CONTENTS

BOTTLE				ANALYSIS	SAMPLER		LAB
No	Type	Size	Preserv.		Filt. (Y/N)	Observations	Observations
2	VTB	40	GC/MS.	VOLATILES	N		

CHAIN OF CUSTODY CHRONICLE

1. Shuttle Opened By: (print) [illegible] Date: [illegible] Time: [illegible]
Signature: [illegible] Seal #: [illegible] Intact: [illegible]

2. I have received these materials in good condition from the above person.
Name: ______ Signature: ______
Date: ______ Time: ______ Remarks: ______

3. I have received these materials in good condition from the above person.
Name: ______ Signature: ______
Date: ______ Time: ______ Remarks: ______

4. Shuttle Sealed By: (print) [illegible] Date: 10 16 96 Time: 0926
Signature: [illegible] Seal #: 005159 Intact: YES

LAB USE ONLY Opened By: ______ Date: ______ Time: ______
SHUTTLE # ______ TEMP. °C ______ SEAL # ______ COND. ______

CORELAB ENVIRONMENTAL TESTING SERVICES EDISON, N.J.

CHAIN OF CUSTODY FORM (CC1)

Seal No. ______ CORE Job # ______

Date Sealed ______ By: ______

Company: AMERADA HESS CORPORATION Attn.: DAVE WILSON

Facility/Site: PT. READING REFINERY Phone: ( ) -

Address: 750 CLIFF ROAD, PT. READING, NJ

SAMPLE IDENTIFICATION

Facility: HHCCFFCCNM (Facility/Site Code) (Optional Sample Point Descriptions)

Sample Point: W (Source Code (from below)) - 61-1 (Your Sample Point ID (left justify)) 961016 (Start Date (YY/MM/DD)) 1659 (Start Time (2400 hr. clock)) (Elapsed Hours (composite))

Source Codes:
Well ..(W) Outfall.......(O) Bottom Sediment....(B) Surface Impoundment....(I) Leachate Collection Sys.....(C) Other ....(X)
Soil ...(S) River/Stream..(R) Generation Point....(G) Treatment Facility......(T) Lake/Ocean..........(L) Specify ______

SHUTTLE CONTENTS

BOTTLE				ANALYSIS	SAMPLER		LAB
No	Type	Size	Preserv.		Filt. (Y/N)	Observations	Observations
2	VOA	40	HCL	VOLATILES	N		
1	VS	40	HCL	VOA SCREEN			
2	EXT	1000	NONE	625/BN			
1	METP	1000	HNO3	FILTERED METALS	Y		
1	CONU	500	NONE	PH/SCOND	N		
1	CYAN	500	NaOH	CYAN/MACRO (CHYN)			
1	CONS	500	H2SO4	PHENOLS/MACRO (CHYN			
1	TEMP	40	NONE	TEMPERATURE			
1	METP	1000	HNO3	TOTAL METALS (BPJ207			

CHAIN OF CUSTODY CHRONICLE

1. Shuttle Opened By: (print) D. [illegible] Date: 10/16/96 Time: [illegible]
Signature: [illegible] Seal #: 00506 Intact: Y

2. I have received these materials in good condition from the above person.
Name: ______ Signature: ______
Date: ______ Time: ______ Remarks: ______

3. I have received these materials in good condition from the above person.
Name: ______ Signature: ______
Date: ______ Time: ______ Remarks: ______

4. Shuttle Sealed By: (print) [illegible] Date: 10 16 96 Time: 1724
Signature: [illegible] Seal #: 005244 Intact: Y

LAB USE ONLY Opened By: ______ Date: ______ Time: ______
SHUTTLE # ______ TEMP. °C ______ SEAL # ______ COND. ______

CORE LAB ENVIRONMENTAL TESTING SERVICES — EDISON, N.J.

CHAIN OF CUSTODY FORM (CC1)

Seal No. ______ CORE Job # ______

Date Sealed ______ By: ______

Company: AMERADA HESS CORPORATION   Attn.: DAVE WILSON

Facility/Site: PT. READING REFINERY   Phone: ( ) -

Address: 750 CLIFF ROAD. PT. READING. NJ

SAMPLE IDENTIFICATION

Facility: AHCFAFOGNM (Facility/Site Code)   (Optional Sample Point Descriptions)

Sample Point: W-L1-2 — Source Code (from below) / Your Sample Point ID (left justify)   Start Date (YY/MM/DD): 96/10/16   Start Time (2400 hr. clock): 1141   Elapsed Hours (composite): --

Source Codes:
Well ..(W) Outfall.......(O) Bottom Sediment....(B) Surface Impoundment....(I) Leachate Collection Sys.....(C) Other ......(X)
Soil ...(S) River/Stream..(R) Generation Point....(G) Treatment Facility ......(T) Lake/Ocean ....(L) Specify ______

SHUTTLE CONTENTS

BOTTLE No	Type	Size	Preserv.	ANALYSIS	SAMPLER Filt. (Y/N)	SAMPLER Observations	LAB Observations
2	VOA	40	HCL	VOLATILES	N		
1	VS	40	HCL	VOA SCREEN	/		
2	EXT	1000	NONE	625/BN	N		
1	METP	1000	HNO3	FILTERED METALS	Y		
1	CONU	500	NONE	PH/SCOND	N		
1	CYAN	500	NaOH	CYAN/MACRO (CHYN)			
1	CONS	500	H2SO4	PHENOLS/MACRO (CHYN			
1	TEMP	40	NONE	TEMPERATURE			
1	METP	1000	HNO3	TOTAL METALS (BPJ208	N		

CHAIN OF COUSTODY CHRONICLE

1. Shuttle Opened By: (print) D. Pullen   Date: 10 - -   Time: -
Signature: D. P-   Seal #: 05277   Intact: Y

2. I have received these materials in good condition from the above person.
Name: ______ Signature: ______
Date: ______ Time: ______ Remarks: ______

3. I have received these materials in good condition from the above person.
Name: ______ Signature: ______
Date: ______ Time: ______ Remarks: ______

4. Shuttle Sealed By: (print) D. Pullen   Date: 10 16 96   Time: 1223
Signature: D. P-   Seal #: 005277   Intact: YES

LAB USE ONLY Opened By: ______ Date: ______ Time: ______

SHUTTLE # ______ TEMP. °C ______ SEAL # ______ COND. ______

CORE LAB
ENVIRONMENTAL TESTING SERVICES
EDISON, N.J.

CHAIN OF CUSTODY FORM (CC1)

SAMPLER

Seal No.: ______ CORE Job #: ______

Date Sealed: ______ By: ______

Company: AMERADA HESS CORPORATION Attn.: DAVE WILSON

Facility/Site: PT. READING REFINERY Phone: ( ) -

Address: 750 CLIFF ROAD, PT. READING, NJ

SAMPLE IDENTIFICATION

Facility: H H C F T R C G W M (Facility/Site Code) (Optional Sample Point Descriptions)

Sample Point: W - L 1 - 3 | 9 6 / 1 0 / 1 6 | 1 3 0 8 | —

Source Code (from below) | Your Sample Point ID (left justify) | Start Date (YY/MM/DD) | Start Time (2400 hr. clock) | Elapsed Hours (composite)

Source Codes:
Well ..(W) Outfall.......(O) Bottom Sediment....(B) Surface Impoundment....(I) Leachate Collection Sys.....(C) Other ......(X)
Soil ...(S) River/Stream..(R) Generation Point....(G) Treatment Facility ....(T) Lake/Ocean ....(L) Specify ______

SHUTTLE CONTENTS

BOTTLE				ANALYSIS	SAMPLER		LAB
No	Type	Size	Preserv.		Filt. (Y/N)	Observations	Observations
2	VOA	40	HCL	VOLATILES	N		
1	VS	40	HCL	VOA SCREEN	/		
2	EXT	1000	NONE	625/BN	/		
1	METP	1000	HNO3	FILTERED METALS	Y		
1	CONU	500	NONE	PH/SCOND	N		
1	CYAN	500	NaOH	CYAN/MACRO (CHYN)			
1	CONS	500	H2SO4	PHENOLS/MACRO (CHYN			
1	TEMP	40	NONE	TEMPERATURE			
1	METP	1000	HNO3	TOTAL METALS (BPJ209			

CHAIN OF CUSTODY CHRONICLE

1. Shuttle Opened By: (print) D Wilson Date: 10/16/96 Time: 0710
Signature: D Wilson Seal #: 005371 Intact: Yes

2. I have received these materials in good condition from the above person.
Name: ______ Signature: ______
Date: ______ Time: ______ Remarks: ______

3. I have received these materials in good condition from the above person.
Name: ______ Signature: ______
Date: ______ Time: ______ Remarks: ______

4. Shuttle Sealed By: (print) D Wilson Date: [illegible] Time: 1338
Signature: D Wilson Seal #: 005868 Intact: Yes

LAB USE ONLY Opened By: ______ Date: ______ Time: ______
SHUTTLE # ______ TEMP. °C ______ SEAL # ______ COND. ______

CORELAB ENVIRONMENTAL TESTING SERVICES EDISON, N.J.

CHAIN OF CUSTODY FORM (CC1)

SAMPLER

Seal No.: ______ CORE Job #: ______

Date Sealed: ______ By: ______

Company: AMERADA HESS CORPORATION Attn.: DAVE WILSON

Facility/Site: PT. READING REFINERY Phone: ( ) -

Address: 750 CLIFF ROAD. PT. READING, NJ

SAMPLE IDENTIFICATION

Facility: AHCFFPLGPM (Facility/Site Code) (Optional Sample Point Descriptions)

Sample Point: W - L1-4 (Source Code (from below) / Your Sample Point ID (left justify)) 961016 (Start Date (YY/MM/DD)) 1501 (Start Time (2400 hr. clock)) Elapsed Hours (composite)

Source Codes:
Well ..(W) Outfall ....(O) Bottom Sediment ....(B) Surface Impoundment....(I) Leachate Collection Sys.....(C) Other ....(X)
Soil ...(S) River/Stream ..(R) Generation Point ....(G) Treatment Facility ....(T) Lake/Ocean ....(L) Specify ______

SHUTTLE CONTENTS

BOTTLE No	Type	Size	Preserv.	ANALYSIS	SAMPLER Filt. (Y/N)	SAMPLER Observations	LAB Observations
2	VOA	40	HCL	VOLATILES	N		
1	VS	40	HCL	VOA SCREEN			
2	EXT	1000	NONE	625/BN			
1	METP	1000	HNO3	FILTERED METALS	Y		
1	CONU	500	NONE	PH/SCOND	N		
1	CYAN	500	NaOH	CYAN/MACRO (CHYN)			
1	CONS	500	H2SO4	PHENOLS/MACRO (CHYN			
1	TEMP	40	NONE	TEMPERATURE			
1	METP	1000	HNO3	TOTAL METALS (BPJ210			

CHAIN OF CUSTODY CHRONICLE

1. Shuttle Opened By: (print) D P WILSON Date: [illegible] Time: [illegible]
Signature: [signature] Seal #: [illegible] Intact: Y

2. I have received these materials in good condition from the above person.
Name: ______ Signature: ______
Date: ______ Time: ______ Remarks: ______

3. I have received these materials in good condition from the above person.
Name: ______ Signature: ______
Date: ______ Time: ______ Remarks: ______

4. Shuttle Sealed By: (print) D P WILSON Date: 10-16-90 Time: 1538
Signature: D P Wilson Seal #: 5057 Intact: YES

LAB USE ONLY Opened By: ______ Date: ______ Time: ______
SHUTTLE # ______ TEMP. °C ______ SEAL # ______ COND. ______

BG 2 CORE # BPJ 200 / 206 TIME 1734
SEAL # 005096 TEMP 66 F / 66 F
PH 6.19 6.16 6.20 6.13
COND 250 250 250 250
PH CAL 4.0 7.0 READ 10.0 9.96 COND 1000
LEACHATE #1 2F CORE # BPJ 400 TIME 1805
SEAL # 5032 TEMP 68 F / 68 F
PH 7.00 6.96 6.85 6.84
COND 1900 1900 1900 1900
PH CAL 4.0 7.0 READ 10.0 9.93 COND 1000

APPENDIX 3
Site-Specific IGW
Soil Remediation Standards

IMPACT TO GROUNDWATER (IGW) ALTERNATIVE REMEDIATION STANDARDS (ARS)

A. SESOIL RUNS

To evaluate if the maximum measured soil concentrations could be left in place at the Site without impacting groundwater, **SESOIL** vadose zone modeling, within SEVIEW software, was performed for the VOC COC at the Site:

- Benzene,

the constituent for which the Thiessen Polygon Method Averages were determined to be higher than the NJDEP Default IGW Soil Screening Levels (SSLs).

SESOIL Input Concentrations

Benzene – IGW SSL = 0.005 mg/kg

Depth	Max
0-2	0.156
2-4	0.156
4-6	0.156
6-14	*0.156*

Grey – below water table

The vadose zone input parameters were selected primarily from the available Site-specific data, as per NJDEP guidance. The following sections present the input parameters used to perform fate and transport modeling, and to calculate soil leachate concentrations to the groundwater aquifer.

SESOIL INPUT

Climate Data - The temporal variation of infiltration is calculated in SESOIL using an internal climate database specific for Woodbridge, New Jersey (Latitude 40.558 and Longitude 74.285).

Setup SESOIL and AT123D Runs

Climate | Chemical | Soil | Washload | Application | Source Size | AT123D

Save As | Open

WOODBRIDGE | Climate Database

	Temp (Celsius)	Cloud Cover (fraction)	Relative Humidity (fraction)	Short Wave Albedo (fraction)	Evapotrans (cm/day)	Precip (cm/month)	Storm Length (days)	# of Storms (storms/month)	Rainy Season (days)
Oct	12.22	0.500	0.655	0.200	0.00	9.982	0.540	4.08	30.40
Nov	6.67	0.600	0.660	0.200	0.00	11.125	0.510	5.30	30.40
Dec	1.67	0.650	0.660	0.450	0.00	10.135	0.570	5.52	30.40
Jan	-1.11	0.650	0.660	0.500	0.00	10.338	0.550	5.17	30.40
Feb	0.00	0.600	0.630	0.500	0.00	7.849	0.570	5.17	30.40
Mar	4.44	0.600	0.605	0.200	0.00	10.617	0.560	6.22	30.40
Apr	10.00	0.650	0.565	0.200	0.00	10.541	0.540	5.85	30.40
May	15.56	0.600	0.605	0.200	0.00	12.497	0.450	6.44	30.40
Jun	21.11	0.600	0.610	0.200	0.00	10.566	0.310	5.66	30.40
Jul	23.89	0.600	0.615	0.200	0.00	13.183	0.350	5.69	30.40
Aug	22.78	0.550	0.640	0.200	0.00	10.998	0.380	5.41	30.40
Sep	18.33	0.550	0.665	0.200	0.00	11.557	0.490	4.44	30.40

Chemical data – Chemical properties for the COCs at the Site are from the internal SESOIL database.

Setup SESOIL and AT123D Runs

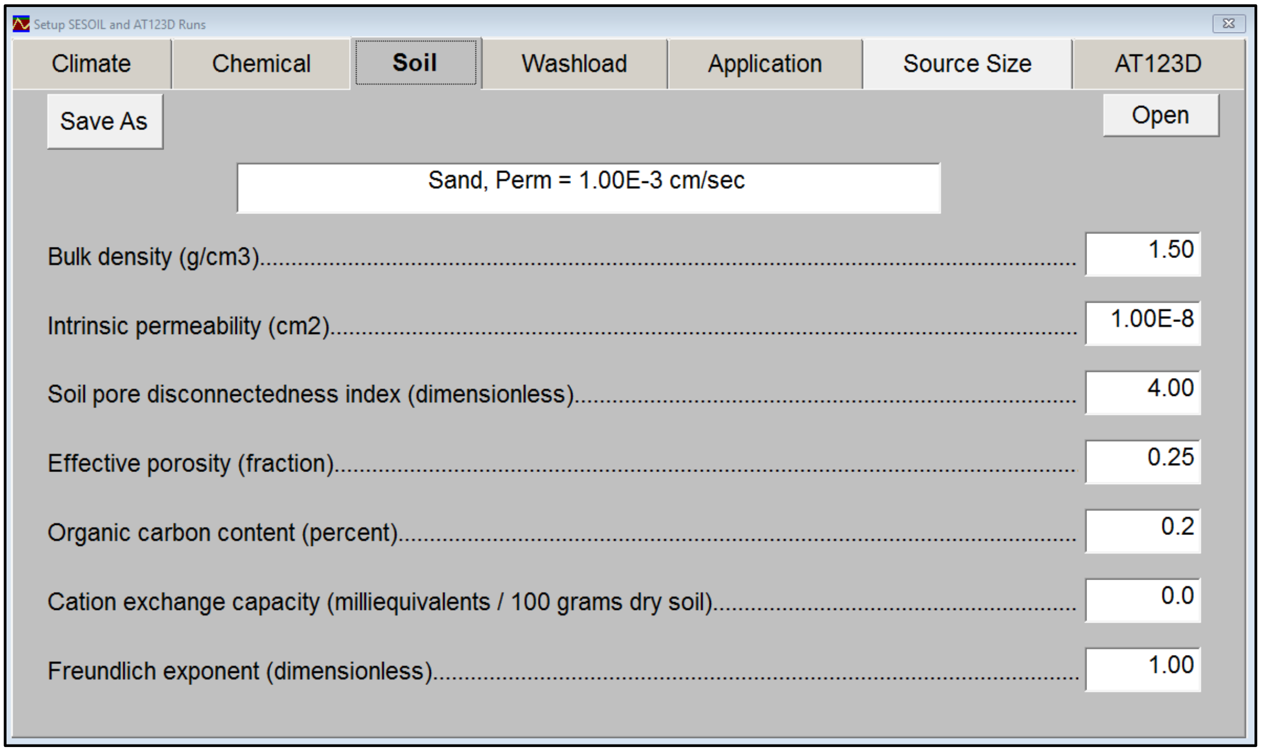
Climate | Chemical | Soil | Washload | Application | Source Size | AT123D

Save As | Open

Benzene, NJDEP | Chemical Database

Parameter	Value	Parameter	Value
Water solubility (mg/L)	1.75E+3	Air diffusion coefficient (cm2/sec)	8.80E-2
Henry's Law constant (m3-atm/mol)	5.55E-3	Molecular weight (g/mole)	78.11
Koc (adsorption) (ug/g)/(ug/ml)	5.89E+1		
Kd (adsorption) (ug/g)/(ug/ml)	0.0		
Chemical valence (g/mole)	0.0	Neutral hydrolysis rate constant (1/day)	0.0
Base hydrolysis rate constant (1/day)	0.0	Acid hydrolysis rate constant (1/day)	0.0
Liquid phase biodegradation rate (1/day)	0.023	Ligand dissociation constant (dimensionless)	0.0
Solid phase biodegradation rate (1/day)	0.023	Moles ligand/mole chemical (dimensionless)	0.0
Water diffusion coefficient (cm /sec)	9.80E-6	Molecular weight ligand (g/mol)	0.0

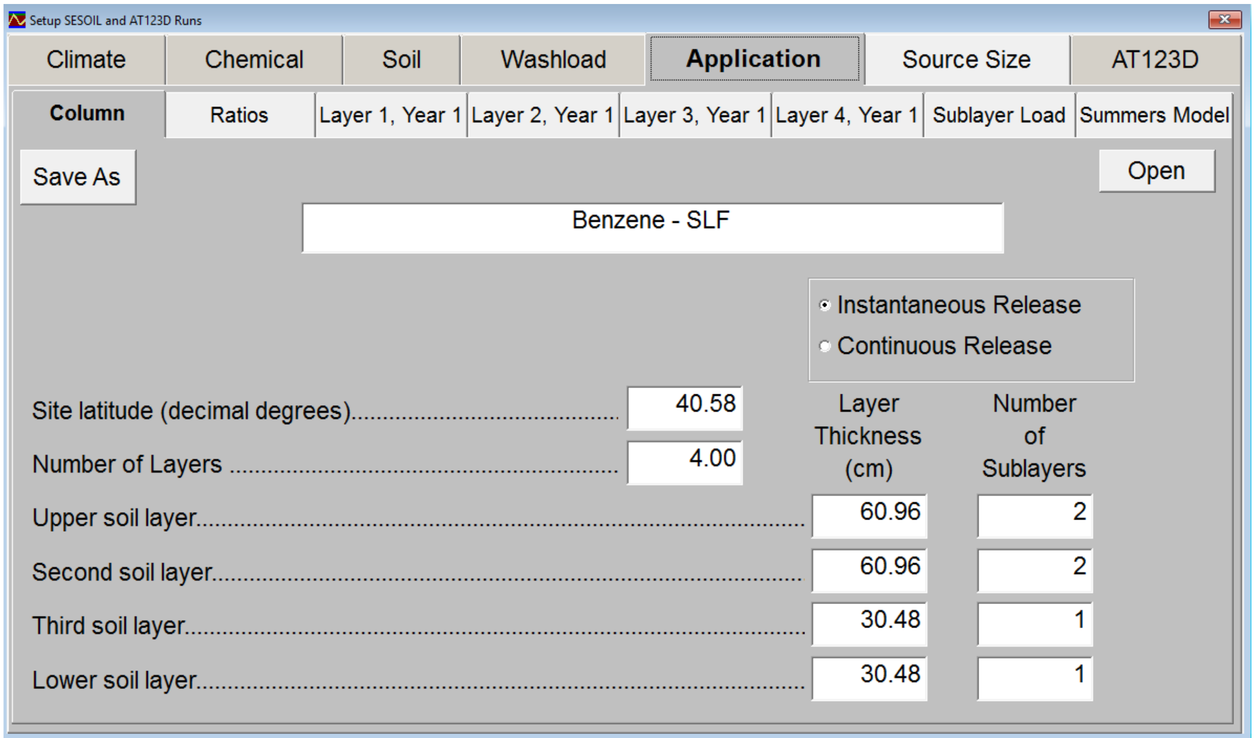
Soil data – Since site-specific data was not available NJDEP Default sand was used for the Site.



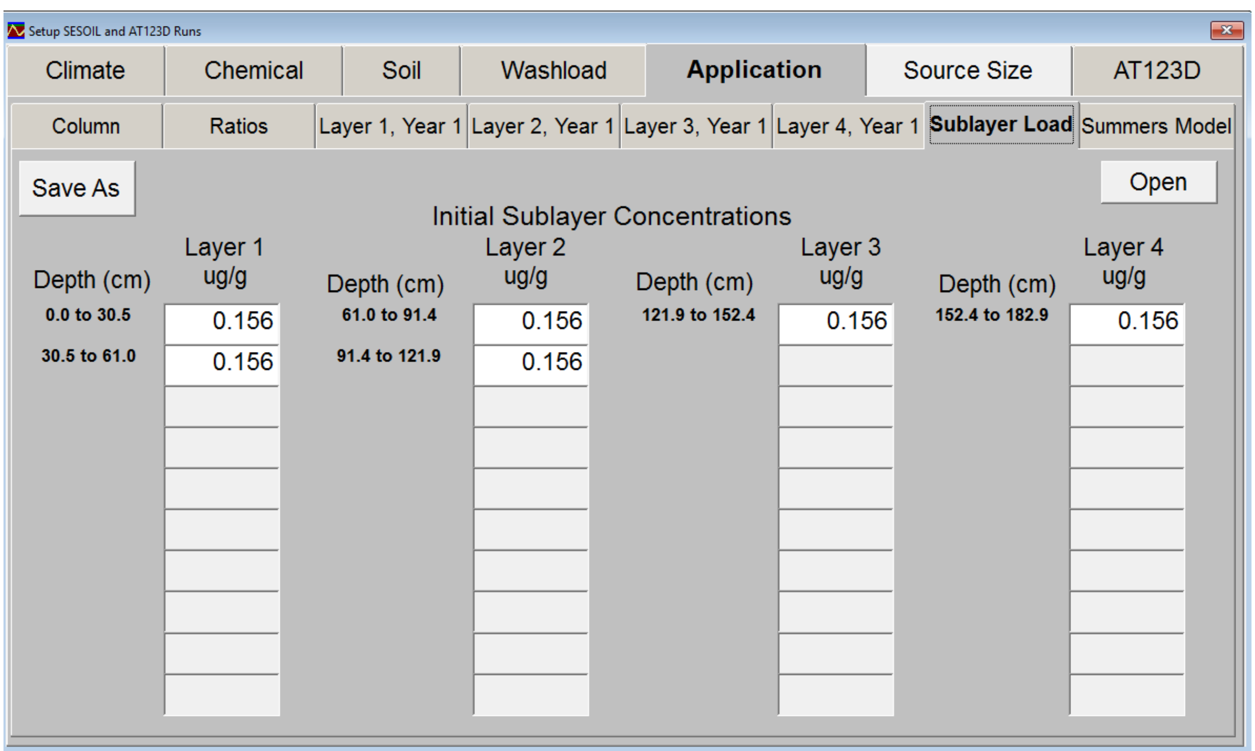
Application Data – This includes source volume and location relative to the water table. The Benzene, Toluene, Ethylbenzene, Xylenes and Chlorobenzene sources at the site were assumed conservatively to cover the whole AOC: ~400' x 400' = 160,000 sq. feet.

The maximum concentrations distributions in the soil column to the water table are summarized in tables below, over the 6-foot-deep vadose zone, as confirmed by Table 1, in the RAW / PCMP, which presents the depth to groundwater.

Soil Column Information



Benzene Concentration Distribution



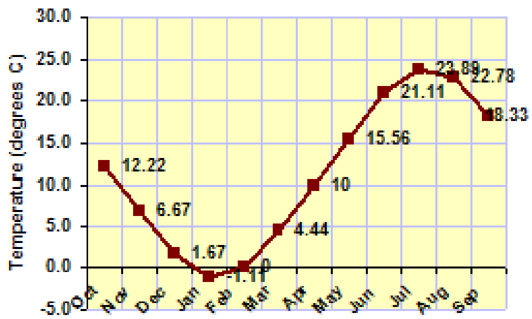
SESOIL OUTPUT

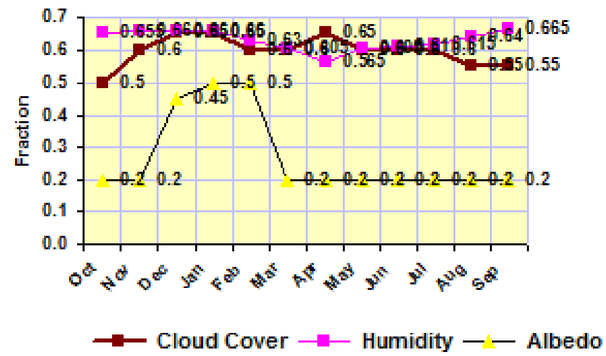
Climate Report

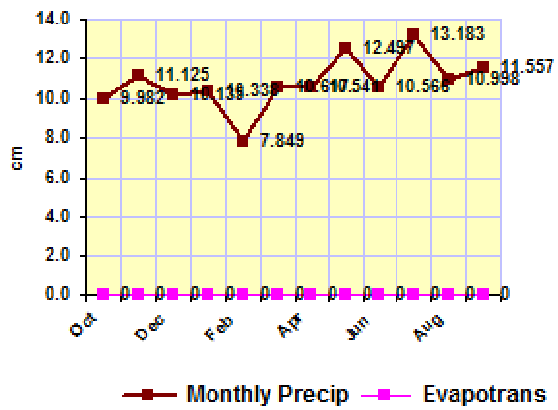
Location Description: WOODBRIDGE

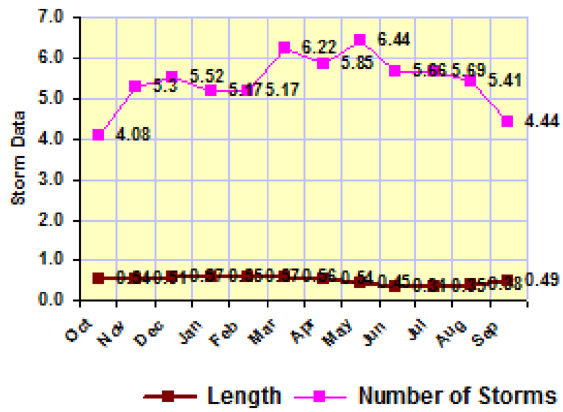
Climate Input File: C:\SEV7 WIN7\WOODBRIDGE.CLM

Month	Temperature		Precipitation		Evapotranspiration Rate		Storms		Cloud Cover	Albedo	Humidity
Units	^{o}C	^{o}F	cm	inches	cm	inches	per Month	Length Days	Fraction	Fraction	Fraction
October	12.22	54.00	9.982	3.93	0.00	0.00	4.08	0.540	0.500	0.200	0.655
November	6.67	44.01	11.125	4.38	0.00	0.00	5.30	0.510	0.600	0.200	0.660
December	1.67	35.01	10.135	3.99	0.00	0.00	5.52	0.570	0.650	0.450	0.660
January	-1.11	30.00	10.338	4.07	0.00	0.00	5.17	0.550	0.650	0.500	0.660
February	0.00	32.00	7.849	3.09	0.00	0.00	5.17	0.570	0.600	0.500	0.630
March	4.44	39.99	10.617	4.18	0.00	0.00	6.22	0.560	0.600	0.200	0.605
April	10.00	50.00	10.541	4.15	0.00	0.00	5.85	0.540	0.650	0.200	0.565
May	15.56	60.01	12.497	4.92	0.00	0.00	6.44	0.450	0.600	0.200	0.605
June	21.11	70.00	10.566	4.16	0.00	0.00	5.66	0.310	0.600	0.200	0.610
July	23.89	75.00	13.183	5.19	0.00	0.00	5.69	0.350	0.600	0.200	0.615
August	22.78	73.00	10.998	4.33	0.00	0.00	5.41	0.380	0.550	0.200	0.640
September	18.33	64.99	11.557	4.55	0.00	0.00	4.44	0.490	0.550	0.200	0.665









SESOIL Profile and Load Report

Layer No.	Number of Sub-Layers	Thickness		Intrinsic Permeability	Organic Carbon Content	Adsorption Coefficient	Cation Exchange Capacity	Freundlich Exponent	Solid Phase Degradation Rate	Liquid Phase Degradation Rate	Soil pH
		cm	feet	cm2	percent	ug/g / ug/mL	mEq / 100 g soil	unitless	1/day	1/day	pH
1	2	61.0	2.0	1.00E-8	0.20	0.00	0.00	1.00	2.30E-02	2.30E-02	7.00
2	2	61.0	2.0	1.00E-8	0.20	0.00	0.00	1.00	2.30E-02	2.30E-02	7.00
3	1	30.5	1.0	1.00E-8	0.20	0.00	0.00	1.00	2.30E-02	2.30E-02	7.00
4	1	30.5	1.0	1.00E-8	0.20	0.00	0.00	1.00	2.30E-02	2.30E-02	7.00

Bulk Density (g/cm ^{3})	1.50
Effective Porosity (fraction)	0.25
Soil Pore Disconnectedness	4.00

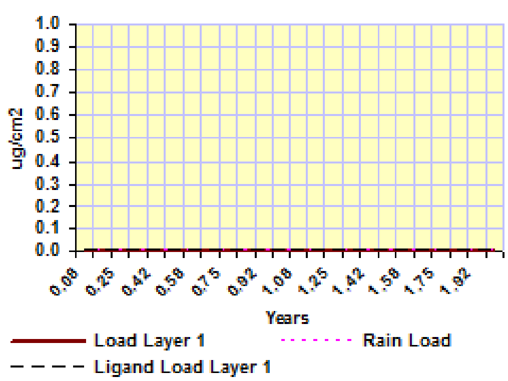
Area cm2 / ft2	.44E+8 / .55E+5
Latitude degrees	40.6
Spill Index	1

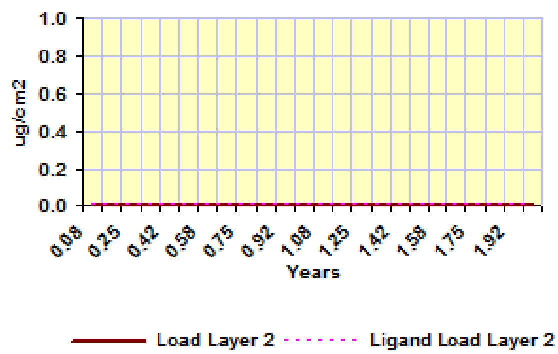
Water Solubility ug/mL	1.75E+3
Henry's Law (M ^{3}atm/mol)	5.55E-3
Koc (Adsorp) (ug/g)/(ug/mL)	58.90
Kd (Adsorp) (ug/g)/(ug/mL)	0.00
Valence (g/mole)	0.00
Air Diffusion Coefficient (cm ^{2}/sec)	8.80E-2
Water Diffusion Coefficient (cm ^{2}/sec)	9.80E-6
Molecular Weight (g/mole)	78.10

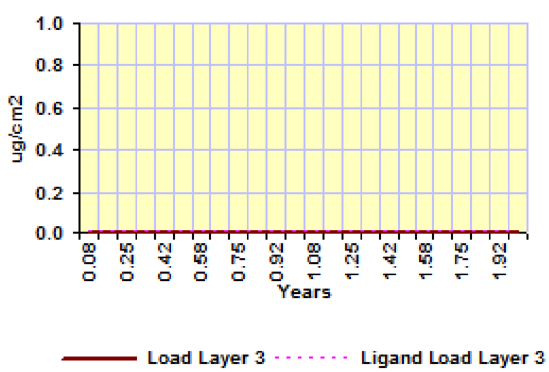
Moles Ligand / Moles Chemical	0.00
Moles Ligand Weight (g/mole)	0.00
Koc (Desorp) (ug/g)/(ug/mL)	0.00
Kd (Desorp) (ug/g)/(ug/mL)	0.00
Ligand Dissociation Constant	0.00
Base Hydrolysis Rate (L/mol/day)	0.00
Neutral Hydrolysis Rate (L/mol/day)	0.00
Acid Hydrolysis Rate (L/mol/day)	0.00

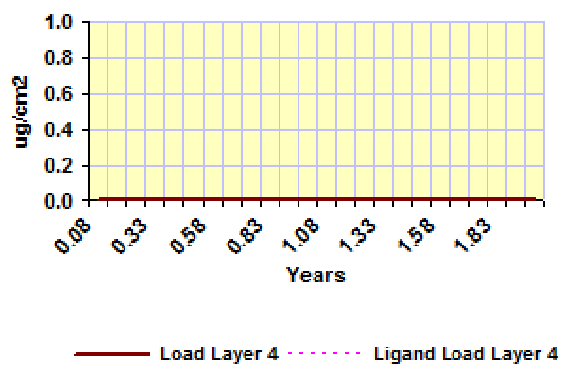
Output File: Benzene LF1
c:\SEV7 WIN7\S01.OUT
Chemical File: Benzene. NJDEP
C:\SEV7 WIN7\BENZENE NJDEP.CHM
Soil File: Sand. Perm = 1.00E-3 cm/sec
C:\SEV7 WIN7\SAND.SOI
Application File: Benzene - SLF
C:\SEV7 WIN7\CLB-SLF.APL

Sublayer Loads		1	2	3	4	5	6	7	8	9	10
Layer 1	ug/g	1.56E-01	1.56E-01								
Layer 2	ug/g	1.56E-01	1.56E-01								
Layer 3	ug/g	1.56E-01									
Layer 4	ug/g	1.56E-01									





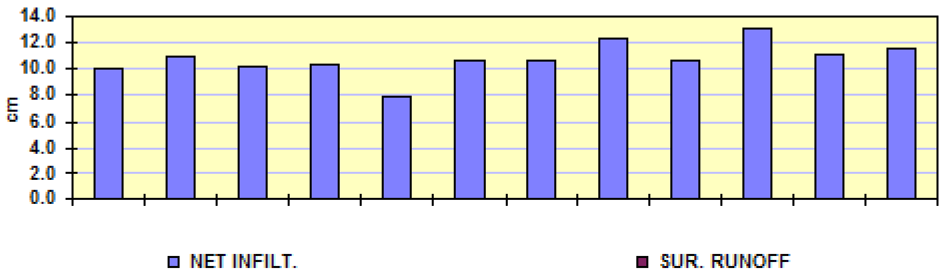


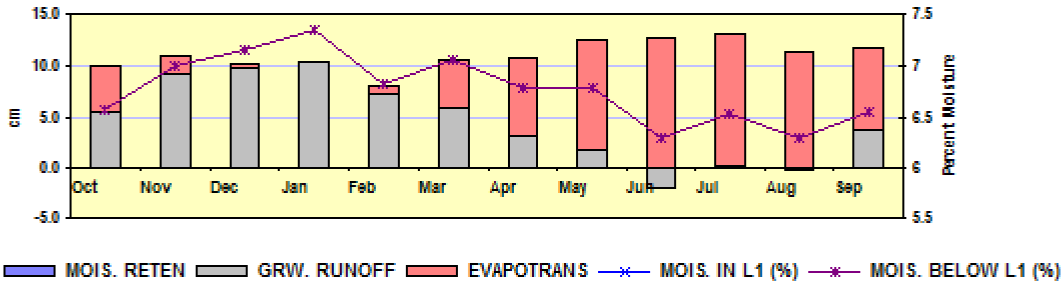


SESOIL Hydrologic Cycle Report

Scenario Description: Benzene LF1

SESOIL Output File: c:\SEV7 WIN7\S01.OUT





	Surface Water Runoff		Net Infiltration		Evapotranspiration		Soil Moisture Retention		Groundwater Runoff (Recharge)		Soil Moisture	
											Layer 1	Below Layer 1
Units	cm	Inches	cm	Inches	cm	Inches	cm	Inches	cm	Inches	Percent	Percent
October	0.00	0.00	10.02	3.94	4.52	1.78	0.00	0.00	5.49	2.16	6.58	6.58
November	0.00	0.00	11.02	4.34	1.77	0.69	0.07	0.03	9.19	3.62	7.00	7.00
December	0.00	0.00	10.16	4.00	0.30	0.12	0.02	0.01	9.83	3.87	7.15	7.15
January	0.00	0.00	10.31	4.06	0.00	0.00	0.03	0.01	10.28	4.05	7.35	7.35
February	0.00	0.00	7.91	3.11	0.84	0.33	-0.08	-0.03	7.15	2.81	6.83	6.83
March	0.00	0.00	10.60	4.17	4.82	1.90	0.03	0.01	5.75	2.26	7.05	7.05
April	0.00	0.00	10.64	4.19	7.46	2.94	-0.04	-0.02	3.22	1.27	6.78	6.78
May	0.00	0.00	12.40	4.88	10.56	4.16	0.00	0.00	1.84	0.72	6.78	6.78
June	0.00	0.00	10.60	4.17	12.61	4.96	-0.07	-0.03	-1.94	-0.76	6.30	6.30
July	0.00	0.00	13.13	5.17	12.81	5.04	0.03	0.01	0.29	0.11	6.53	6.53
August	0.00	0.00	11.05	4.35	11.37	4.48	-0.03	-0.01	-0.29	-0.11	6.30	6.30
September	0.00	0.00	11.62	4.57	7.79	3.07	0.04	0.01	3.79	1.49	6.55	6.55
Total	0.00	0.00	129.43	50.96	74.85	29.47	0.00	0.00	54.58	21.49	- -	- -

SESOIL Pollutant Cycle Report

Scenario Description: Benzene LF1
SESOIL Output File: c:\SEV7 WIN7\S01.OUT

SESOIL Process	Pollutant Mass (ug)	Percent of Total
Volatilized	3.200E+09	51.92
In Soil Air	1.113E+00	0.00
Sur. Runoff	0.000E+00	0.00
In Washload	0.000E+00	0.00
Ads On Soil	4.653E+00	0.00
Hydrol Soil	0.000E+00	0.00
Degrad Soil	1.855E+09	30.10
Pure Phase	0.000E+00	0.00
Complexed	0.000E+00	0.00
Immobile CEC	0.000E+00	0.00
Hydrol CEC	0.000E+00	0.00
In Soil Moi	1.725E+00	0.00
Hydrol Mois	0.000E+00	0.00
Degrad Mois	7.043E+08	11.43
Other Trans	0.000E+00	0.00
Other Sinks	0.000E+00	0.00
Gwr. Runoff	4.033E+08	6.54
Total Output	6.162E+09	100.00
Total Input	6.163E+09	
Input - Output	1.059E+05	

Maximum leachate concentration 1.759E-01 mg/l

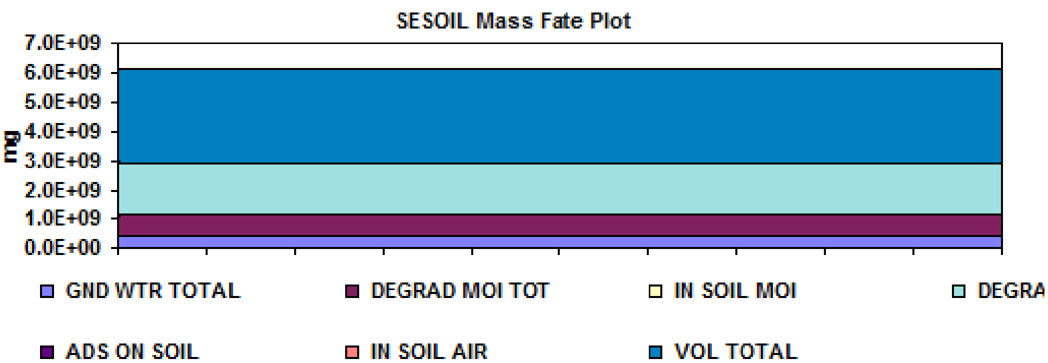
Climate File: WOODBRIDGE
C:\SEV7 WIN7\WOODBRIDGE.CLM

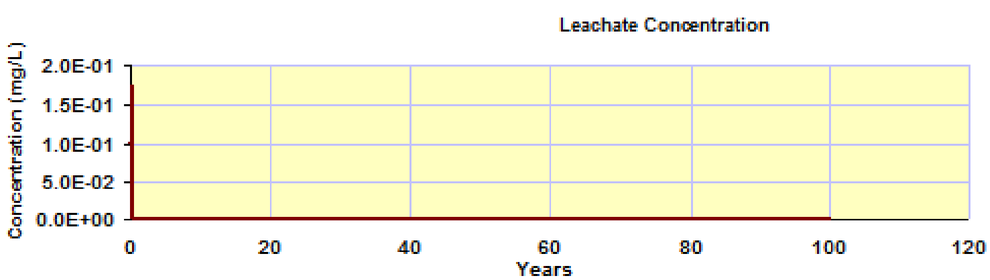
Chemical File:
C:\SEV7 WIN7\BENZENE NJDEP.CHM

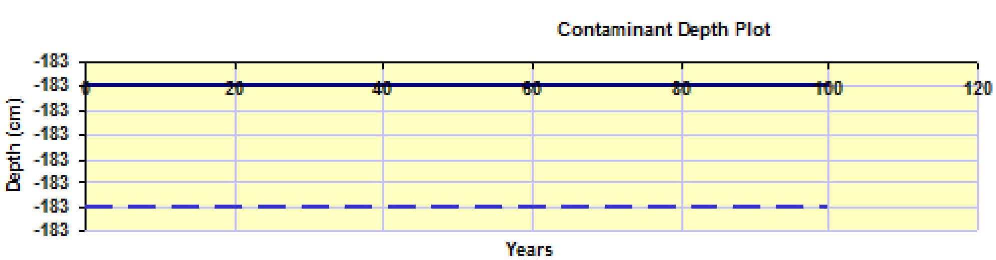
Soil File: Sand. Perm = 1.00E-3 cm/sec
C:\SEV7 WIN7\SAND.SOI

Application File: Benzene - SLF
C:\SEV7 WIN7\CLB-SLF.APL

Starting Depth: 182.90 cm
Ending Depth: 182.90 cm
Total Depth: 183.00 cm







The benzene leachate concentration of 176 ug/L is higher than the benzene leachate criteria of 4 ug/L[1], and since benzene was detected also in groundwater, AT123D model will be run to evaluate if benzene is a concern for the impact to groundwater pathway.

B. AT123D RUNS

Since benzene did not pass the SESOIL screen, and since groundwater was contaminated with this constituent of concern (COCs), SESOIL and AT123D vadose zone and groundwater modeling runs were performed together to evaluate benzene IGW compliance.

INPUT DATA

The hydraulic conductivity, K, for the AT123D runs, was considered to be 0.5 ft/day (0.00635 m/hr), characteristic for the silty sand aquifer beneath the Site.

The hydraulic gradient, i, for the AT123D runs was considered to be 0.004, the average i calculated between L1-1 and L1-4, for the different gauging events from October 22, 2012 to April 21, 2015.

The effective porosity, n_e, of 0.25, soil bulk density, ρ_b of 1.5 kg/L (1.5E+03 kg/m^3) and organic carbon content, k_{oc}, represent NJDEP default values.

Dispersivities were estimated based on the measured plume length using the following equation (Xu and Eckstein 1995):

$$\alpha_L=0.83(\log_{10} L)^{2.414}$$

where:

α_L = longitudinal dispersivity, and

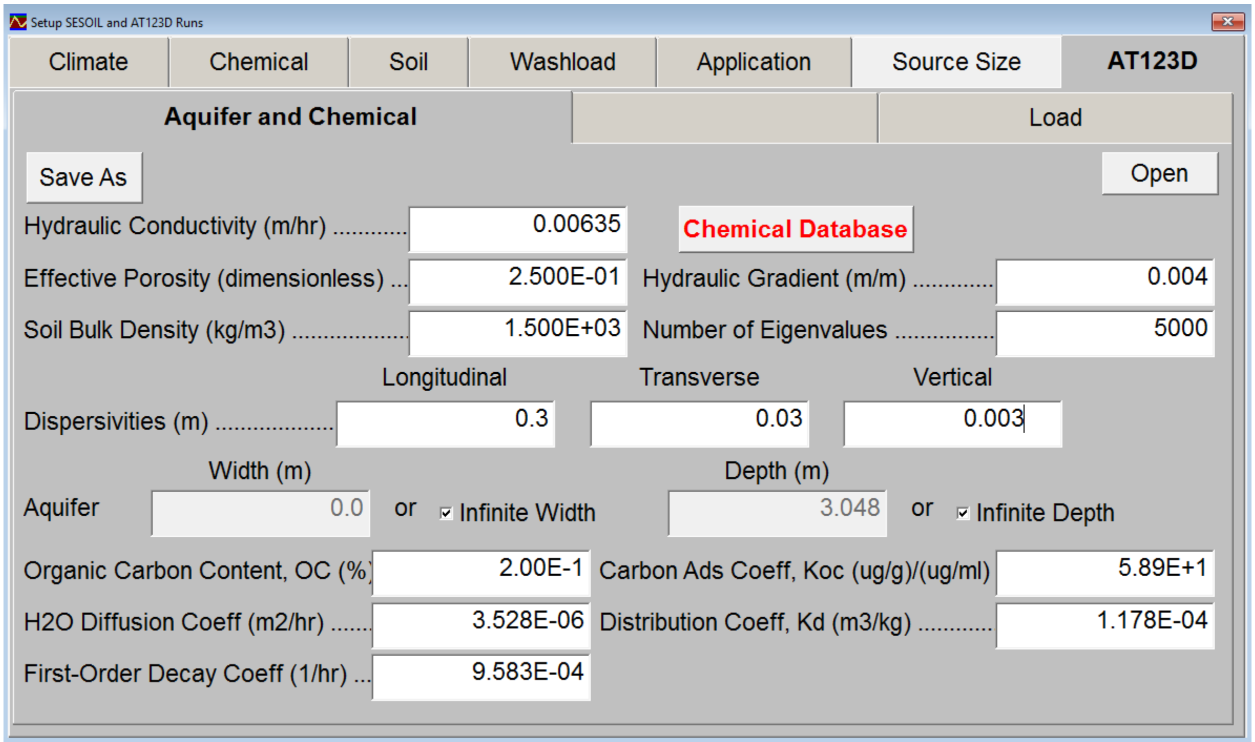
L = length of contaminant plume (meters).

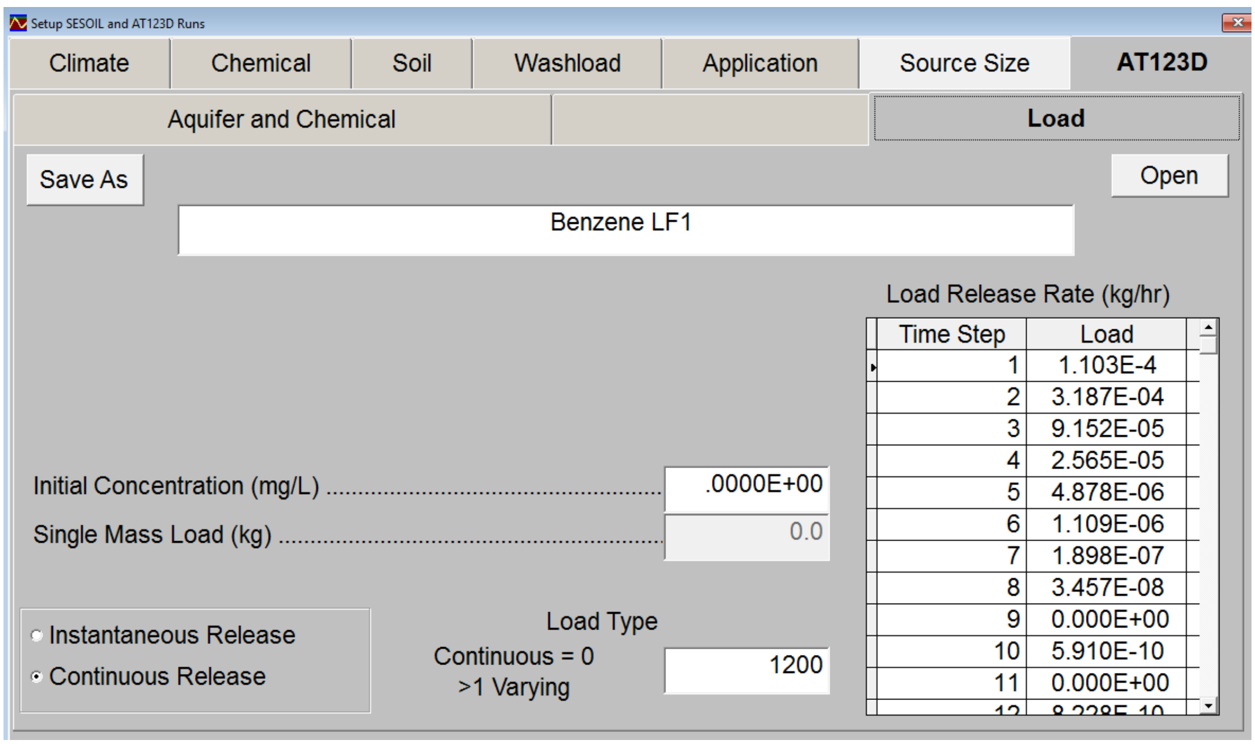
Transverse dispersivity was calculated as 1/10th the longitudinal dispersivity, and vertical dispersivity was calculated as 1/100th the longitudinal dispersivity (Gelhar et al. 1992).

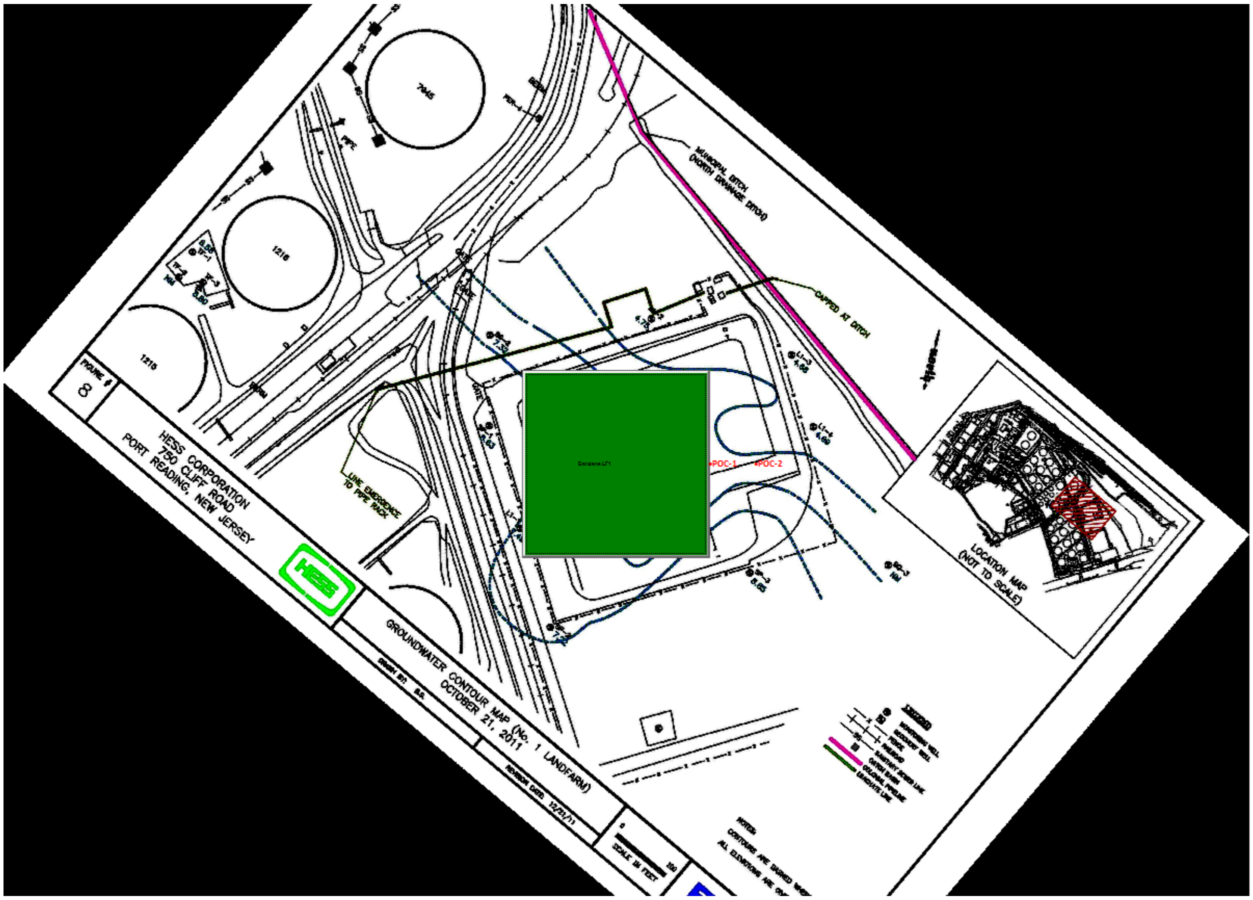
The length of the contaminat plume, L, is about 10 feet, as evaluated in **Appendix 6**, with the CEA extent. Therfore, the longitudinal dispersivity was estimated to be 0.3 m, the transverse dispersivity was estimated to be 0.03 m, and vertical dispersivity was estimated to be 0.003 m.

No decay for benzene was considered in the model.

[1] http://www.nj.gov/dep/srp/guidance/rs/splp_guidance.pdf


Setup SESOIL and AT123D Runs
Climate
Chemical
Soil
Washload
Application
Source Size
AT123D
Aquifer and Chemical
Load
Save As
Open
Hydraulic Conductivity (m/hr) ....
0.00635
Chemical Database
Effective Porosity (dimensionless) ...
2.500E-01
Hydraulic Gradient (m/m) ....
0.004
Soil Bulk Density (kg/m3) ....
1.500E+03
Number of Eigenvalues ....
5000
Longitudinal
Transverse
Vertical
Dispersivities (m) ....
0.3
0.03
0.003
Width (m)
Depth (m)
Aquifer
0.0
or
Infinite Width
3.048
or
Infinite Depth
Organic Carbon Content, OC (%)
2.00E-1
Carbon Ads Coeff, Koc (ug/g)/(ug/ml)
5.89E+1
H2O Diffusion Coeff (m2/hr) ....
3.528E-06
Distribution Coeff, Kd (m3/kg) ....
1.178E-04
First-Order Decay Coeff (1/hr) ...
9.583E-04


Setup SESOIL and AT123D Runs
Climate
Chemical
Soil
Washload
Application
Source Size
AT123D
Aquifer and Chemical
Load
Save As
Open
Benzene LF1
Load Release Rate (kg/hr)
Time Step
Load
1 1.103E-4
2 3.187E-04
3 9.152E-05
4 2.565E-05
5 4.878E-06
6 1.109E-06
7 1.898E-07
8 3.457E-08
9 0.000E+00
10 5.910E-10
11 0.000E+00
Initial Concentration (mg/L) ....
.0000E+00
Single Mass Load (kg) ....
0.0
Instantaneous Release
Continuous Release
Load Type
Continuous = 0
>1 Varying
1200



OUTPUT DATA

The AT123D groundwater simulations prepared for the COCs (benzene, ethylbenzene, xylenes and chlorobenzene) show that:

- At the Point of Compliance, POC-0, below the source, the concentrations decrease below the NJDEP GWQS, within the CEA duration; and

- At the Point of Compliance, POC-1, at the edge of the groundwater plume (CEA extent), the concentrations never exceed the NJDEP GWQS of 1 ug/L.

APPENDIX 4
Quality Assurance Project Plan

QUALITY ASSURANCE PROJECT PLAN

AOC-3: Landfarm No. 1
Hess Corporation – Former Port Reading Complex (HC-PR)
750 Cliff Road
Port Reading, Middlesex County, New Jersey
NJDEP PI# 006148
ISRA Case No. E20130449
EPA ID No. NJD045445483

PREPARED FOR:

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Trenton-Mercer Airport
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SEPTEMBER 2016

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Table of Contents

Introduction

INTRODUCTION

This Quality Assurance Project Plan (QAPP) was prepared by Earth Systems, Inc. (Earth Systems) for Hess Corporation, who is conducting remedial action (RA) activities at an environmental area of concern designated as AOC-3: Landfarm No. 1 (LF1) located at 750 Cliff Road, Port Reading (Woodbridge Township), Middlesex County, New Jersey (Property or site).

The purpose of this QAPP is to ensure that scientific data are acquired according to established methods and procedures designed to obtain results that are objective, true, repeatable, and of known accuracy. Specifically, this QAPP provides guidance and specifications to ensure that SI activities are planned and executed in a manner consistent with the Quality Assurance Objectives (QAO's) stated below:

- Field determinations and analytical results are valid through adherence to New Jersey Department of Environmental Protection (NJDEP) field procedures, NJDEP-approved analytical protocols, and calibration and preventive maintenance of equipment;
- Samples are identified and controlled through sample tracking systems and chain of custody procedures;
- Records are retained as documentary evidence of field activities and observations;
- Samples are collected and analytical data are validated in accordance with the NJDEP requirements; and
- Evaluations of the data are accurate, appropriate, and consistent throughout the project.

The contents of this QAPP are based on the NJDEP requirements as stated in the NJDEP Technical Requirements for Site Remediation and the Quality Assurance Project Plan Technical Guidance (Version 1.0, April 2014). This QAPP includes the following components:

- Problem Definition/Background;
- Project/Task Description;
- Project/Task Organization;
- Data Quality Objectives and Criteria for Measurement Data;
- Historical and Secondary Information/Data;
- Investigative Process Design;
- Field Instrumentation/Equipment Calibration and Frequency;
- Inspection/Acceptance of Supplies and Consumables;
- Sample Handling and Custody Requirements;
- Field Storage and Transport Procedures;
- Sample Containers, Preservation, and Holding Times;
- Analytical Methods Summary Table;
- Project Compounds and Analytical Summary;
- Analytical Quality Control;
- Laboratory Deliverables;
- Data and Records Management;
- Data Verification and Usability; and
- Corrective Action Processes.

As specific conditions and additional information warrant, this QAPP will be amended or revised to include site-specific quality assurance/quality control procedures.

Quality Assurance Project Plan
AOC-3: Landfarm No. 1 (LF1)
Hess Corporation – Former Port Reading Complex
750 Cliff Road
Port Reading, Middlesex County, New Jersey

1. Project Definition / Background

Project Definition

The Hess Corporation – Former Port Reading Complex (HC-PR) is located at 750 Cliff Road in Port Reading, Middlesex County, New Jersey (the Site). The LF1 is a land treatment system located southeast of North Landfarm and encompassing approximately 3.9 acres (170,000 square feet), constructed of diked walls and a silt and clay liner comprised of fill material and native marsh soils.

The LF1 was constructed in 1985 with dredged sediments from Arthur Kill in this area, which was once a saline marsh. The LF1 has a surface elevation of about 10 feet above mean sea level (amsl), and is completely surrounded by dike walls, which prevent surface water runoff. The surface water runoff is collected via storm drains and is sent to the waste water treatment.

A Remedial Action Workplan (RAW) / Post-Closure Monitoring Plan (PCMP) was prepared by Earth Systems, Inc. (Earth Systems) in September 2016 for the SLF which proposed monitoring of the existing wells to determine groundwater contamination extent and contamination duration.

The overall project goals and objectives are summarized below:

- Groundwater Monitoring

The analytical data shall be used to determine if further groundwater monitoring is required. These decisions shall be made following receipt of all analytical data associated with the investigation. Data users for the project include the person responsible for conducting the remediation, the environmental consultant, the LSRP, and ultimately the NJDEP.

2. Project / Task Description

The activities that will be conducted includes sampling of the groundwater monitoring wells using low flow sampling with purge rates monitored and adjusted to stabilize drawdown. All data shall be collected through groundwater sampling and laboratory analysis. No data shall be collected from other sources.

The sample results shall be compared to the applicable remediation standards and a conclusion shall be made, based on the comparison, as to whether the Area of Concern (AOC) is contaminated and requires further investigation or no further investigation is required.

The applicable regulatory quality standards to this phase of investigation are:

- NJDEP Groundwater Quality Standards

3. Project / Task Organization

The NJDEP's "Quality Assurance Project Plan Technical Guidance" recommends that the QAPP include an organizational chart identifying key personnel and/or organizations showing relationships and lines of communication. As stated in Section 5 of the guidance, not all elements of the QAPP may need the same level of detail, which should be based on a graded approach depending on the complexity of the project and the intended use of the data. In this regard, since the number of personnel and organizations is relatively small, the relationships can be described rather than depicted in a chart.

Project Team

The Licensed Site Remediation Professional (LSRP) is John Virgie of Earth Systems. He also serves as the central point of communication with all other individuals and organizations associated with this project. He is responsible for implementing the Quality Assurance Project Plan and coordinating the site investigation activities. He can be reached at (732) 739-6444, extension 22.

The Project Director and On-Site Health and Safety Officer for Earth Systems is Mr. Michael Piegaro. He can be reached at (732) 739-6444, extension 2303.

The Project Manager is Ms. Amy Blake of Earth Systems. She is responsible for coordinating the site investigation activities in the field and tabulating/interpreting the analytical data once received. She can be reached at (732) 739-6444, extension 2305.

Laboratory: SGS Accutest Laboratories, 2235 Route 130, Dayton, New Jersey 08810 (Contact: Mr. Matt Cordova, Project Manager, (732) 355-4550.

Drilling Contractor: S2C2 Inc., 5 Johnson Drive, Suite 12, Raritan, New Jersey 08869 (Contact: Matt Ruf at 908-253-3200)

Drilling Contractor: Uni-Tech Drilling Company, 49 Old York Road, Bridgewater, New Jersey 08807 (Contact: Greg Adams at 908-725-7500)

Special Training Needs/Certification

Training needs and certifications of field oversight include requirements to have completed the OSHA 40-Hour training with annual 8-hour refresher training in accordance with 29 CFR 1910.120 (Hazardous waste operations and emergency response).

The site investigation activities are being conducted under the direction of a Licensed Site Remediation Professional (LSRP).

Special training is required to operate laboratory equipment and conduct laboratory analyses. Laboratory certification is established at N.J.A.C. 7:18.

4. Data Quality Objectives and Criteria for Measurement Data

Data quality objectives ("DQOs") are qualitative and quantitative statements that are developed in the first six (6) steps of the DQO process. DQOs define the purpose of the data collection effort, clarify what the data should represent to satisfy this purpose, and specify the performance requirements for the quality of information to be obtained from the data.

In accordance with Section 5.4 of the NJDEP's "Quality Assurance Project Plan" technical guidance, the development of the data quality criteria can be developed through the formal DQO process described in the EPA document titled "Guidance for the Data Quality Objectives Process", EPA/600/R-96/055. For most projects, however, a less iterative process is normally used to develop the project-specific DQOs.

Data of Known Quality Protocols ("DKQP") describe specific laboratory quality assurance and quality control procedures which, if followed, will provide data of known and documented quality (i.e. scientific reproducible and reliable data). When data of known quality ("DKQ") is obtained, an evaluation of the data with respect to its intended purpose can be made. To this end, a NJDEP-certified laboratory must be used to analyze samples whenever possible.

Typical DQOs are often expressed in terms of data quality indicators ("DQIs") including precision, accuracy, representativeness, comparability, completeness and sensitivity (also known as the "PARCCS" parameters). These measures of performance are discussed in detail below.

<u>Precision</u>
Precision is the measure of agreement among repeated measurements of the same property under identical or substantially similar testing conditions. The investigator will determine the precision of the data by:

- Using the same analytical methods to perform repeated analyses on the same sample (laboratory or matrix duplicates);
- Collection of a field duplicate and submittal of both to evaluate the precision from sample collection, for sample handling, preservation and storage and analytical measurements

Precision for laboratory and field measurements can be expressed as the relative percent difference ("RPD") between two duplicate determinations or percent relative standard deviation ("%RSD") between multiple determinations.

Acceptance criteria for field precision shall be assessed through the splitting of a sample in the field and submitting both to the laboratory. Field duplicates will be collected at a frequency of one (1) per twenty (20) investigative samples per matrix per analytical parameter. Precision will be measured through the calculation of RPD. The resulting information will be used to assess sample homogeneity, spatial variability at the site, sample collection reproducibility, and analytical variability.

<u>Accuracy</u>
Accuracy is the degree of agreement of a measured value and an accepted reference or true value. The difference between the measured value and the reference or true value includes components of both systematic error (bias) and random error (precision). It should be noted that precise data may not be accurate data. Accuracy can be expressed as a percent recovery or percent deviation of the measurement with respect to its known or true value.

The accuracy will be determined through establishing acceptance criteria for spike recoveries (e.g., surrogate recoveries, laboratory control sample recoveries, matrix spike recoveries, reference material recoveries etc.) or allowable deviations for calibration (e.g., %RPD for calibration verification). Acceptance criteria for matrix spike measurements are expressed as a percent recovery and are usually specified in the analytical method (or laboratory SOP, as applicable). Various blank samples (laboratory or field) may also be used to assess contamination of samples that may bias results high. Accuracy in the field shall be assessed through the adherence to sample collection, handling, preservation, and holding time requirements.

Representativeness
Representativeness is a qualitative measurement that describes the extent to which analytical data represent the site conditions. In almost every project, the investigator will not be able to measure the whole system, process, or situation of interest. Instead, the investigator will choose sample locations, quantities, and analyses in order to capture a sufficiently broad and/or weighted view of the situation.

Representativeness in the laboratory is ensured by using the proper analytical procedures, appropriate methods, and meeting sample holding times. Following the detailed requirements outlined in the EPA methods and the laboratory SOPs will maximize the representativeness of the laboratory data.

Comparability
Comparability is a qualitative term that expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Comparability is defined as the extent to which data from one data set can be compared directly to similar or related data sets and/or decision-making standards.

Historical data should be evaluated to determine whether they may be combined with data being collected in present time. Comparability should discuss comparisons of sample collection and handling methods, sample preparation, and analytical procedures, holding times, stability issues and QA protocol.

Comparability in the laboratory is dependent on the use of recognized methods and approved laboratory SOPs. Comparability in the field is dependent upon adherence to the sampling methodology and that the proper preservation techniques are used.

Completeness
Completeness is a measure of the amount of usable data collected compared to the amount of data expected to be obtained. Three measures of completeness are defined as:

- Sampling completeness, defined as the number of valid samples collected relative to the number of samples planned for collection;
- Analytical completeness, defined as the number of valid sample measurements relative to the number of valid samples collected; and
- Overall completeness, defined as the number of valid sample measurements relative to the number of samples planned for collection.

Sensitivity
Sensitivity refers to the ability of an analytical procedure to quantify an analyte at a given concentration. The sensitivity requirements should be established such that the laboratory method Reporting Limits ("RLs") are at or below the relevant and applicable regulatory limits for each Contaminant of Concern ("COC") for the project. For the purpose of SRP projects:

- The RL for a specific substance when determining the extent and degree of polluted soil, groundwater, or sediment from a release. For the purpose of this document, the RL is defined as:

- Organics, the lowest initial calibration standard as adjusted for the dilution factor, sample weight/volume, and moisture content;
- Inorganics, the concentration of that analyte in the lowest level check standard (which could be the lowest calibration standard in a multi-point calibration curve).

Methods for analysis have been chosen to meet the sensitivity requirements for a project (e.g., compound-specific and matrix-specific). If however, the laboratory RLs exceed the project sensitivity requirements (i.e., the RL is above the relevant and applicable regulatory standard), the analytical methods may need to be adjusted (e.g., analysis conducted using a more sensitive method or sample preparation and analysis features adjusted to gain sensitivity) and/or the project objectives may need to be adjusted (i.e., certain COCs may not be able to be screened out during this phase of the evaluation).

5. Historical and Secondary Information / Data

The potential sources of data for any project include both historical data (i.e. data not collected by the current investigator) and secondary data (i.e. data that were collected for a different purpose than that for which they are now being used). Historical data should be evaluated for applicability to current project objectives. Secondary data should be assessed to determine if the quality of the data is sufficient for the current project objectives and meets comparability criteria (it is not sufficient that the secondary data were produced by a reliable source or a known environmental monitoring project with an approved QAPP).

6. Investigation Process Design

A description and justification of the investigation design should include, for each area of interest:

- The COCs or other parameters of interest
- The number of anticipated investigation points and how and why they will be selected including a site map depicting proposed sample locations
- Method of obtaining/determining locational information (such as the use of GPS instrumentation)
- Factors which could affect the variability of the data such as physical obstructions, seasonal variations, tidal influences, soil profile changes, weather-related variation, and process variation within the source
- Design basis i.e. probability based or judgment based
- Results comparison (i.e. versus previous data, regulatory standards, reference population, etc.)
- Matrices to be monitored including any special sampling requirements
- Monitoring frequency (if applicable)
- Heterogeneity or homogeneity of the matrix
- Appropriateness of composite samples
- Required quality control samples

The investigative process design is based generally on the following:

- The Technical Requirements for Site Remediation N.J.A.C. 7:26E.
- Field Sampling Procedures Manual (August 2005).

7. Field Quality Control

Field quality control activities, along with their frequency, acceptance criteria, and corrective actions to be taken are provided for each DQI in the following table:

Analyte(s)	**DQI**	**Data Quality Element**	**Frequency of Collection**	**Acceptance Criteria**	**Corrective Action(s)**
All	Representativeness & Precision	Field Duplicate	One (1) per 20 samples per matrix per analyte	RPD ≤ 25% for results > 5x RL; Professional judgment for	Potential data usability issue /possible rejection of data

Field equipment cleaning / decontamination are not expected to be required as all field equipment shall be dedicated to each individual sample.

8. Field Instrumentation / Equipment Calibration and Frequency

Field instrumentation/equipment that will require calibration includes a photoionization detector (PID). Calibration and routine maintenance procedures are presented in the User's Manual. Documentation of the maintenance and calibration records is stored at the office or in the field logbook.

9. Inspection / Acceptance of Supplies and Consumables

Critical supplies or consumables (e.g., pre-cleaned containers, pre-preserved containers, tubing, etc.) shall be inspected for visible indications of contamination and damage and, if none are identified, then the supplies/consumables shall be accepted for use.

10. Sample Handling and Custody Requirements

Sample handling shall be as specified in Section 2.5.5.1 of the FSPM and Section 4.6.2.2 of the NJDEP's "Data Quality Assessment and Data Usability Evaluation Technical Guidance", Version 1.0, dated April 2014. Specifically, samples shall be maintained on-site for no more than two (2) consecutive days, and shall be delivered to the laboratory within one (1) day of shipment from the field.

The chain of custody procedure to be utilized in the field is specified in Section 2.3.6 of the FSPM. The chain of custody procedure to be used in the laboratory shall be in accordance with Section 2.3.6 of the FSPM as well as the laboratory's standard operating procedure.

11. Field Storage and Transport Procedures

Samples shall remain in direct site and in the custody of field personnel at all times until transfer to the laboratory.

12. Sample Containers, Preservation, and Holding Times

Sample containers, preservation, and holding times are specified on Table 1.

13. Analytical Methods Summary Table

Analytical methods are summarized on Table 1.

14. Project Compounds and Analytical Summary

Groundwater samples will be collected and analyzed for Volatile Organic Compounds and Target Analyte Metals. Analytical sensitivity requirements include the use of instruments or methods to detect the contaminants of concern at or below the action limits. The RLs are expected to be below the applicable regulatory standards. NJDEP and EPA methods were selected to achieve the action limits. Laboratories may need to adjust RLs based on dilutions, sample sizes, extract/digestate volumes, percent solids and cleanup procedures. Sensitivity will be maximized by following the NJDEP and EPA methods or laboratory SOPs utilizing experienced, trained laboratory personnel and by conducting laboratory audits.

15. Analytical Quality Control

Quality assurance and quality control ("QA/QC") requirements for analysis are specified in the most recent version of the document titled "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", prepared by EPA. The laboratory may also have QA/QC procedures in addition to those specified by the test method (Appendix 1).

16. Laboratory Deliverables

The laboratory deliverable format to be used for this project shall be the reduced laboratory deliverable format as described in Appendix A of N.J.A.C. 7:26E. The laboratory shall also generate Hazsite files and spreadsheets of the analytical results.

17. Data and Records Management

The recording media for the project will be both paper and electronic. The project will implement proper document control procedures for both, consistent with NJDEP's Quality Management Plan. For instance, hand-recorded data records will be taken with indelible ink, and changes to such data records will be made by drawing a single line through the error with an initial by the responsible person. The Project Manager will have ultimate responsibility for any and all changes to records and documents. Similar controls will be put in place for electronic records.

The Quality Assurance Coordinator shall retain all updated versions of the QAPP and be responsible for distribution of the current version of the QAPP. The Quality Assurance Coordinator and the Project Manager will approve periodic updates. The Project Manager shall retain copies of all management reports, memoranda, and all correspondence between the parties identified in Section 3.

Project data shall be stored in the Project Manager's office. Laboratory records management is described in Appendix 1.

18. Data Verification and Usability

The procedure for review (verification and usability procedures) including data assessment versus stated data quality objectives of the investigation is specified in the NJDEP's "Data Quality Assessment and Data Usability Evaluation Technical Guidance", Version 1.0, dated April 2014.

19. Corrective Action Processes

Corrective action in the field may be needed when the work plan is modified (i.e. number or locations of samples) or when sampling procedures and/or field analytical procedures require modification due to unexpected conditions. The corrective action may be implemented at the time the determination is made in the field or may be implemented later, depending on the circumstances. Any corrective actions taken shall be documented in the field logbook and in the technical report.

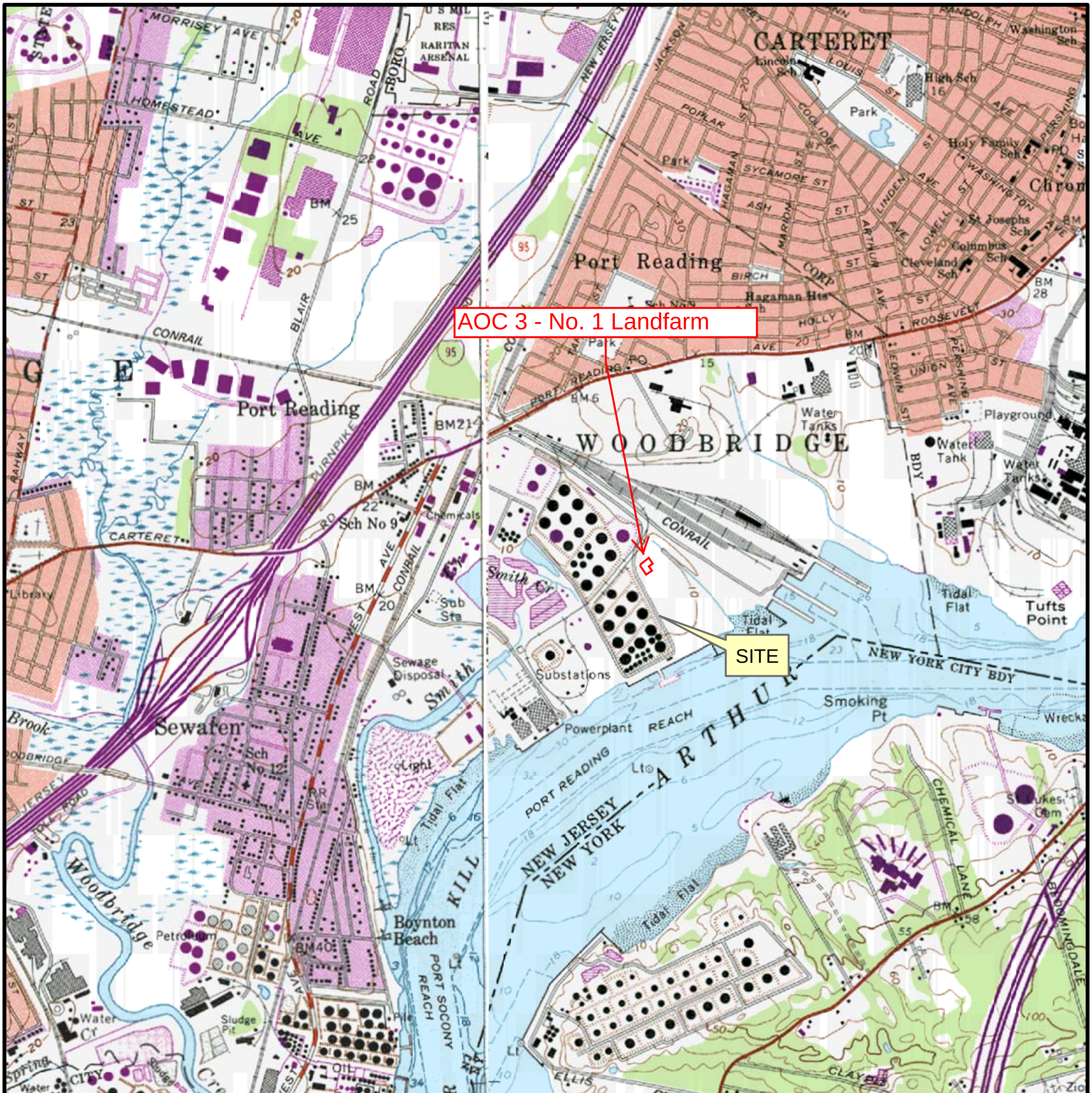
Corrective actions in the laboratory may be needed when Non-Conformances occur. The laboratory shall implement and document corrective actions in accordance with the laboratory SOP.

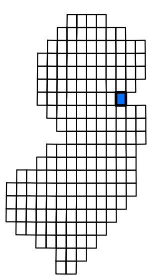
Table 1: Analytical Methods / Quality Assurance Summary Table

TABLE 1
Analytical Methods/Quality Assurance Summary Table
AOC-3: Landfarm No. 1, Hess Corporation – Former Port Reading Complex, Port Reading, Middlesex County, New Jersey

Matrix type	Number of Samples	Number of Blanks	Number of Duplicates	Analytical Parameters	Analytical Methods	Sample Preservation	Sample Container & Volume	Permissible Holding Time
Soil	0	0	0	Extractable Petroleum Hydrocarbons	EPH 10/08 Rev 3	4ºC	Amber glass 4 ounce	14 days to extract, 40 days after extraction to test
	0	0	0	Volatile Organic Compounds	8260B	4ºC methanol	Clear glass 40 mL	14 days
	0	0	0	Semi-Volatile Organic Compounds	8270C	4ºC	Clear glass 4 oz.	14 days to extract, 40 days after extraction to test
	0	0	0	Metals	6020	4ºC	Clear glass 4 oz.	180 days
	0	0	0	SPLP Metals	1312	4ºC	Clear glass 4 oz.	180 days to extract, 180 days after extraction to test
	0	0	0	Mercury	7471A	4ºC	Clear glass 4 oz.	28 days
	0	0	0	PCBs	8082	4ºC	Clear glass 4 oz.	14 days to extract, 40 days after extraction to test
	0	0	0	Pesticides	8081A	4ºC	Clear glass 4 oz.	14 days to extract, 40 days after extraction to test
	0	0	0	Cyanide, Total	9012A	4ºC	Clear glass 4 oz.	14 days
	0	0	0	Phenol	9066	4ºC	Clear glass 4 oz.	28 days
Ground Water	0	0	0	Volatile Organic Compounds	624	4ºC, HCl	Clear glass 40 mL	14 days
	9	1 FB	0	Unfiltered Metals	6020A	4ºC, HNO_3	0.5 L plastic or glass	180 days
	9	1 FB	0	Semi-Volatile Organic Compounds	8270C	4ºC	Amber glass 1 L w/TFE lined cap	7 days to extract, 40 days after extraction to test
Soil Gas	0	0	0	Volatile Organic Compounds	Low Level TO-15	none	Stainless steel 1 L Summa canister	15 days from evacuation to return to lab, 30 days to analyze
Indoor Air	0	0	0	Volatile Organic Compounds	Low Level TO-15	none	Stainless steel 6 L Summa canister	15 days from evacuation to return to lab, 30 days to analyze

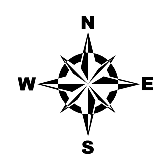
Figure 1: Site Location Map





QUADRANGLE LOCATION:
ARTHUR KILL, NEW JERSEY

SOURCE: ENVIROTRAC



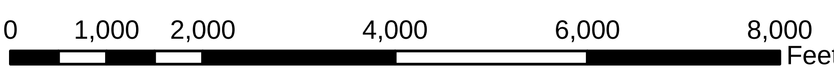


FIGURE 1	U.S.G.S. TOPOGRAPHIC MAP HESS - PORT READING 750 CLIFF ROAD PORT READING, NEW JERSEY	PROJECT # PR DATE: 11/24/2015	Earth Systems Environmental Engineering 43 W. Front Street, Keyport, NJ 07735 T. 732.739.6444 | F. 732.739.0451

Figure 2: Location of Areas of Concern

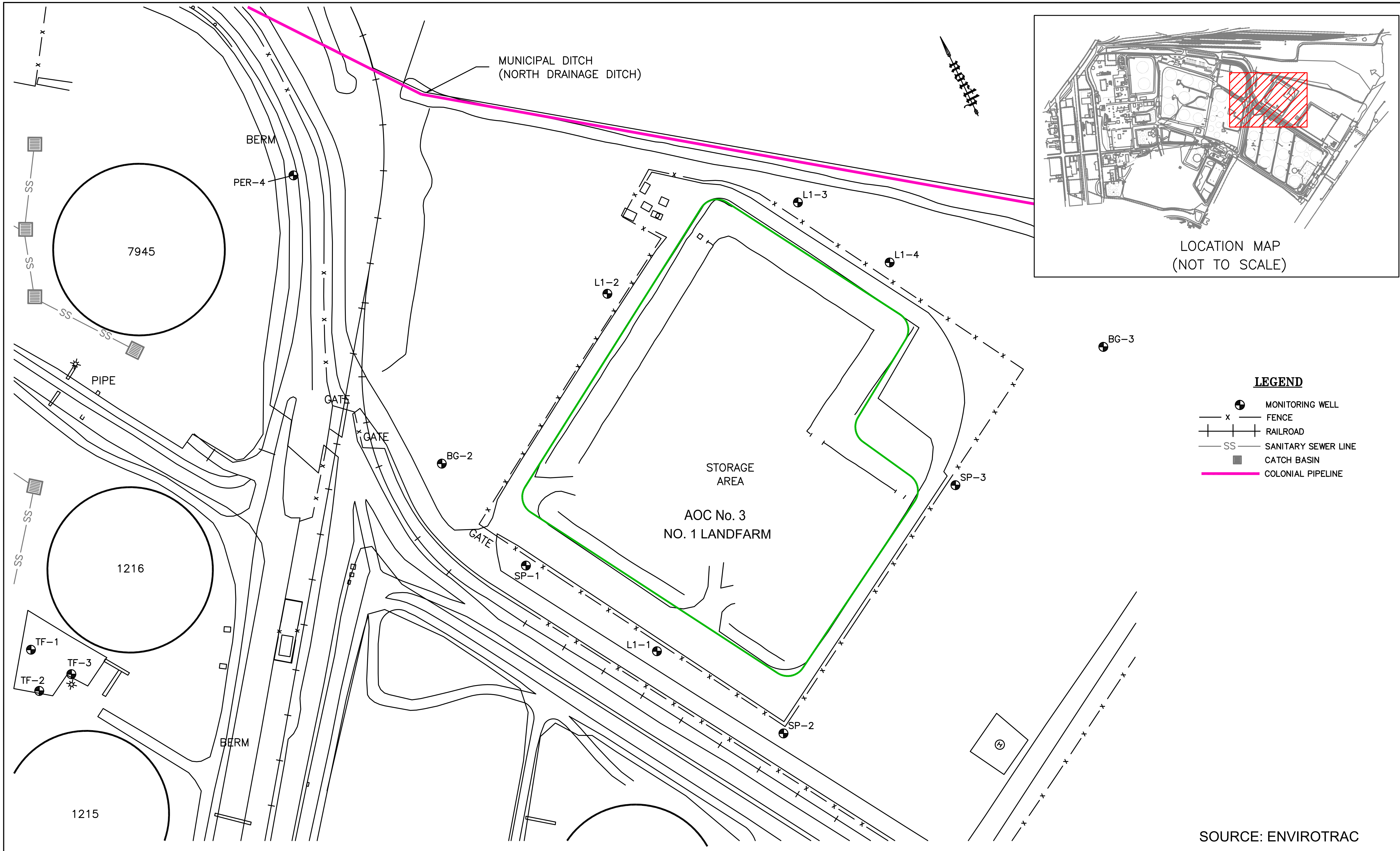


FIGURE 2	HESS - PORT READING 750 CLIFF ROAD PORT READING, NEW JERSEY	PROPERTY MAP AOC-3 — No. 1 LANDFARM	0 100 SCALE IN FEET	Earth Systems Environmental Engineering 43 W. Front Street, Keyport, NJ 07735 T. 732.739.6444 | F. 732.739.0451
		PROJECT # PR	DATE: 11/24/2015	

Appendix 1: Laboratory Quality Assurance / Quality Control Manual

Quality Systems Manual

Volume XVII, Revision II: January 2016

Effective Date: January 2016

Document Control Number: 16

Nancy Cole

Nancy Cole, Laboratory Director
Technical Director-Inorganics

Nicholas C Straccione,
Quality Assurance Manager

SGS Accutest Inc.
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732.329.0200

Introduction

The SGS Accutest Inc. Quality Assurance System, detailed in this plan, has been designed to meet the quality program requirements of the National Environmental Laboratory Accreditation Program (NELAP), ISO Guide 17025, the Department of Defense Environmental Laboratory Approval Program (DOD ELAP) and other National environmental monitoring programs. The plan establishes the framework for documenting the requirements of the quality processes regularly practiced by the Laboratory. The Quality Assurance Director is responsible for changes to the Quality Assurance Program, which is appended to the Quality System Manual (QSM) during the annual program review. The plan is also reviewed annually for compliance purposes by the Company President and Laboratory Director and edited if necessary. Changes that are incorporated into the plan are itemized in a summary of changes following the introduction. Plan changes are communicated to the general staff in a meeting conducted by the Director of Quality Assurance following the plan's approval.

The SGS Accutest Inc. plan is supported by standard operating procedures (SOPs), which provide specific operational instructions on the execution of each quality element and assure that compliance with the requirements of the plan are achieved. SGS Accutest Inc. employees are responsible for knowing the requirements of the SOPs and applying them in the daily execution of their duties. These documents are updated as changes occur and the staff is trained to apply the changes.

At SGS Accutest Inc., we believe that satisfying client requirements and providing a product that meets or exceeds the standards of the industry is the key to a good business relationship. However, client satisfaction cannot be guaranteed unless there is a system that assures the product consistently meets its design requirements and is adequately documented to assure that all procedural steps are executed, properly documented and traceable.

This plan has been designed to assure that this goal is consistently achieved and the SGS Accutest Inc. product withstands the rigors of scrutiny that are routinely applied to analytical data and the processes that support its generation.

Summary of Changes
SGS Accutest Inc. Quality System Manual – January 2016

Section	Page	Description
2.3	7	Chain of Command - Heather Hall _QA Director
3.0	9	QA organizational chart, Heather Hall _QA Director
8.12	34	Added performance limits from section 12.7
12.7	53	Removed, transferred to section 8.12
Appendix I		
Appendix III Methods		

Table of Contents

1.0 QUALITY POLICY

1.1 ***SGS Accutest Inc. Mission***:

SGS Accutest Inc. provides analytical services to commercial and government clients in support of environmental monitoring and remedial activities as requested. The Laboratory's mission is dedicated to providing reliable data that satisfies client's requirements as explained in the following:

"Provide easy access, high quality, analytical support to commercial and government clients which meets or exceeds data quality objectives and provides them with the data needed to satisfy regulatory requirements and/or make confident decisions on the effectiveness of remedial activities."

These services are provided impartially and are not influenced by undue commercial or financial pressures which might impact the staff's technical judgment. Coincidently, SGS Accutest Inc. does not engage in activities that endanger the trust in our independent judgment and integrity in relation to the testing activities performed.

1.2 ***Policy Statement***:

The management and staff of SGS Accutest Inc. share the responsibility for product quality and the commitment to the continual improvement of the quality system. Accordingly, SGS Accutest Inc.'s quality assurance program is designed to assure that all processes and procedures, which are components of environmental data production, meet established industry requirements, are adequately documented from a procedural and data traceability perspective, and are consistently executed by the staff. It also assures that analytical data of known quality, meeting the quality objectives of the analytical method in use and the data user's requirements, is consistently produced in the laboratory. This assurance enables the data user to make rational, confident, cost-effective decisions on the assessment and resolution of environmental issues.

The laboratory Quality System also provides the management staff with data quality and operational feedback information. This enables them to determine if the laboratory is achieving the established quality and operational standards, which are dictated by the client or established by regulation. The information provided to management, through the QA program, is used to assess operational performance from a quality perspective and to perform corrective action as necessary.

All employees of SGS Accutest Inc. participating in environmental testing receive quality system training and are responsible for knowing and complying with the system requirements. The entire staff shares SGS Accutest Inc.'s commitment to good professional practice.

01/19/2016

President & Chief Executive Officer | Date

2.0 ORGANIZATION

2.1 ***Organizational Entity***. SGS Accutest Inc. is a privately held, independent testing laboratory founded in 1956 and registered as a New Jersey Corporation. The headquarters are located in Dayton, New Jersey where it has conducted business since 1987. Satellite laboratories are maintained in Marlborough, Massachusetts; Orlando, Florida, Houston, Texas, San Jose, California, Wheat Ridge, Colorado, and Scott Louisiana.

2.2 *Management Responsibilities*

Requirement: Each laboratory facility has an established chain of command. The duties and responsibilities of the management staff are linked to the Board of Directors/CEO of SGS Accutest Inc. who establishes the agenda for all company activities.

President/CEO. Primary responsibility for all operations and business activities. Delegates authority to laboratory directors, general managers, and the quality assurance director to conduct day to day operations and execute quality assurance duties. Each of the seven operational entities (New Jersey, Florida, Massachusetts, Texas, California, Colorado, and Louisiana) report to the President/CEO.

Laboratory Director. Executes day to day responsibility for laboratory operations including technical aspects of production activities and associated logistical procedures. Reports directly to the President/CEO.

Quality Assurance Director. Design, oversight, and facilitation responsibility for all Quality System elements identified in the Quality Program. Reports directly to the President/CEO.

Technical Directors (Organics/Inorganic). Responsible for day to day operations and activities of the organics and inorganics laboratories including scheduling, production and data quality. Reports directly to the Laboratory Director.

Organics Manager. Responsible for laboratory managers, supervisors and analyst performing daily laboratory procedures in semi-volatiles and organic prep.

Department Managers. Executes day to day responsibility for specific laboratory areas including technical aspects of production activities and associated logistical procedures. Directly report to the laboratory director.

Section Supervisors. Executes day to day responsibility for specific laboratory units including technical aspects of production activities and associated logistical procedures. Direct report to the Department Manager.

2.3 ***Chain of Command***

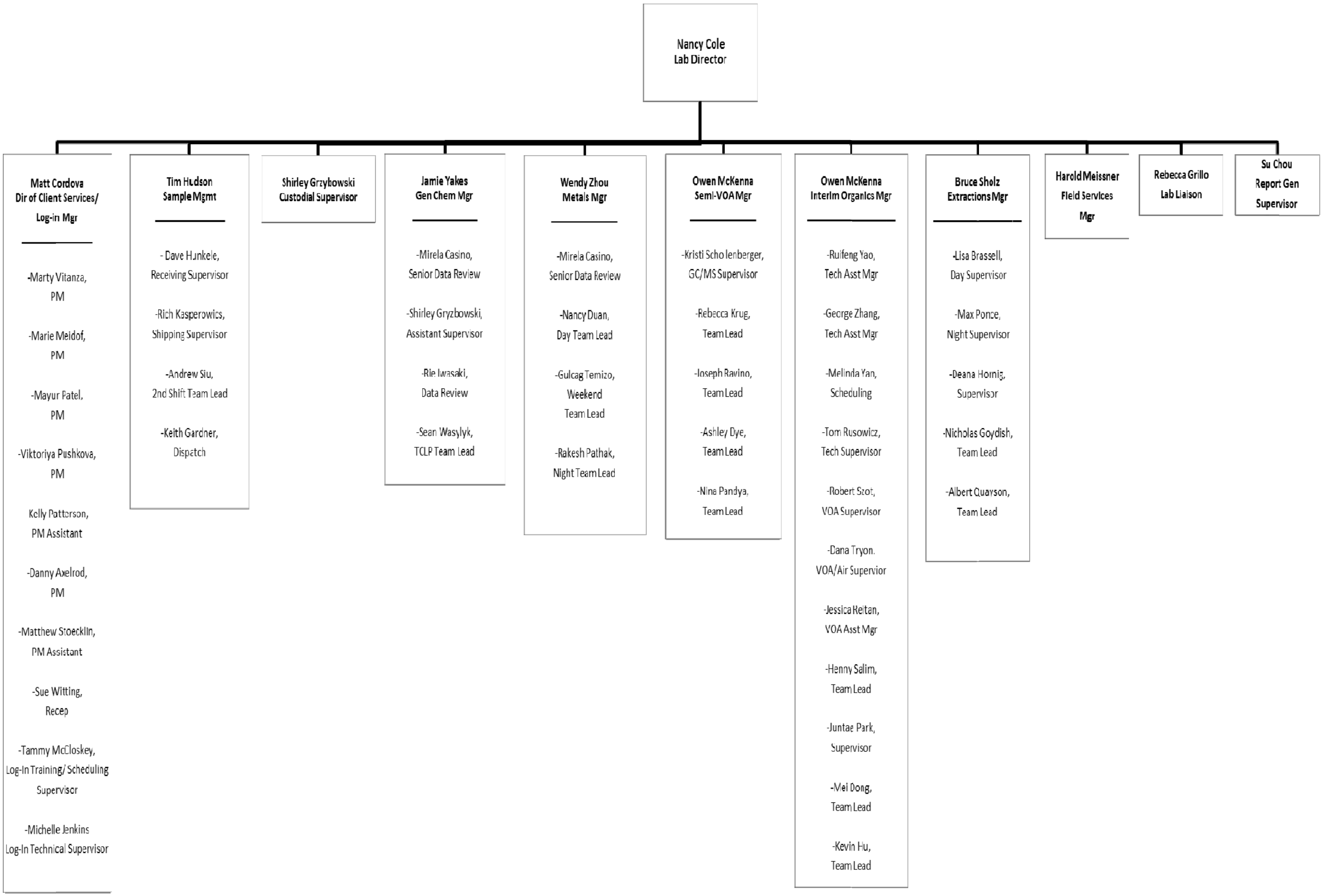
The responsibility for managing all aspects of the Company's operation is delegated to specific individuals, who have been assigned the authority to act in the absence of the senior staff. These individuals are identified in the following Chain of Command:

Karl Schoene, President & Chief Executive Officer SGS Accutest Inc.
Chad Tate, Chief Financial Officer
Nancy Cole, Laboratory Director
Heather Hall, Director, Corporate Quality Assurance
Matt Cordova, Director, Client Services

2.4 ***Organization Chart***

The hierarchy of the Company's operational control and oversight is illustrated in the SGS Accutest Inc. Organization Chart. Employees listed with an asterisk would be considered to be the appointed deputy in the event that the technical director or corporate quality assurance director are absent from their respective position for a period of time exceeding fifteen (15) consecutive calendar days. If this absence exceeds thirty-five (35) consecutive calendar days the laboratory shall notify the NJDEP-Office of Quality Assurance in writing.

Should this absence exceed sixty-five consecutive calendar days the DOD ELAP Accrediting Body shall be notified in writing.


Nancy Cole
Lab Director
Matt Cordova
Dir of Client Services/
Log-in Mgr
-Marty Vitanza,
PM
-Marie Meidof,
PM
-Mayur Patel,
PM
-Viktoriya Pushkova,
PM
Kelly Patterson,
PM Assistant
-Danny Axelrod,
PM
-Matthew Stoecklin,
PM Assistant
-Sue Witting,
Recep
-Tammy McCloskey,
Log-In Training/ Scheduling
Supervisor
-Michelle Jenkins
Log-In Technical Supervisor
Tim Hudson
Sample Mgmt
- Dave Hunkele,
Receiving Supervisor
-Rich Kasperowics,
Shipping Supervisor
-Andrew Siu,
2nd Shift Team Lead
-Keith Gardner,
Dispatch
Shirley Grzybowski
Custodial Supervisor
Jamie Yakes
Gen Chem Mgr
-Mirela Casino,
Senior Data Review
-Shirley Gryzbowski,
Assistant Supervisor
-Rie Iwasaki,
Data Review
-Sean Wasylyk,
TCLP Team Lead
Wendy Zhou
Metals Mgr
-Mirela Casino,
Senior Data Review
-Nancy Duan,
Day Team Lead
-Gulcag Temizo,
Weekend
Team Lead
-Rakesh Pathak,
Night Team Lead
Owen McKenna
Semi-VOA Mgr
-Kristi Schollenberger,
GC/MS Supervisor
-Rebecca Krug,
Team Lead
-Joseph Ravino,
Team Lead
-Ashley Dye,
Team Lead
-Nina Pandya,
Team Lead
Owen McKenna
Interim Organics Mgr
-Ruifeng Yao,
Tech Asst Mgr
-George Zhang,
Tech Asst Mgr
-Melinda Yan,
Scheduling
-Tom Rusowicz,
Tech Supervisor
-Robert Szot,
VOA Supervisor
-Dana Tryon,
VOA/Air Supervior
-Jessica Keltan,
VOA Asst Mgr
-Henny Salim,
Team Lead
-Juntae Park,
Supervisor
-Wei Dong,
Team Lead
-Kevin Hu,
Team Lead
Bruce Sholz
Extractions Mgr
-Lisa Brassell,
Day Supervisor
-Max Ponce,
Night Supervisor
-Deana Hornig,
Supervisor
-Nicholas Goydish,
Team Lead
-Albert Quayson,
Team Lead
Harold Meissner
Field Services
Mgr
Rebecca Grillo
Lab Liaison
Su Chou
Report Gen
Supervisor

Heather Hall
Interim QA Director

- **Nick Straccione Mid-Atlantic QA Mgr**
  - -Greg Tomkovich, Officer
  - -Maria Ruschke, Officer
  - -Kristen Furguson, Officer
  - -Olga Azarian, Officer
  - -Kevin Pang, Officer
- **New England**
  - -Robert Treggiari, Officer
  - -Rachel Conboy, Officer
- **Southeast**
  - -Svetlana Izosimova, Officer
  - -Lovelie Metzgar, Officer
- **Gulf Coast - Texas**
  - -Jane Freemyer, Officer
- **Northern California**
  - -Caitlin Brice, Officer
- **Mountain States**
  - -Kaprie Surprenant, Officer
- **Gulf Coast - Louisiana**
  - -Karen Varnado, Officer
  - -Jenney Babin, Officer

3.0 QUALITY RESPONSIBILITIES OF THE MANAGEMENT TEAM

3.1 ***Requirement***: Each member of the management team has a defined responsibility for the Quality System. System implementation and operation is designated as an operational management responsibility. System design and implementation is designated as a Quality Assurance Responsibility.

President/CEO. Primarily responsible for process improvements to all business aspects of the company.

Laboratory Director. Responsible for implementing and operating the Quality System in all laboratory areas. Responsible for the design and implementation of corrective action for defective processes. Has the authority to delegate Quality System implementation responsibilities.

Quality Assurance Director. Responsible for design, implementation support, training, and monitoring of the quality system. Identifies product, process, or operational defects using statistical monitoring tools and processes audits for elimination via corrective action. Empowered with the authority to halt production if quality issues warrant immediate action. Monitors implemented corrective actions for compliance.

Technical Directors. Responsible for overseeing the technical aspects of the quality assurance system as they are integrated into method applications and employed to assess analytical control on a daily basis. The Technical directors review and acknowledge the technical feasibility of proposed QA systems involving technical applications of applied methodology.

Department Managers. Responsible for applying the requirements of the Quality System in their section and assuring subordinate supervisors and staff apply all system requirements. Initiates, designs, documents, and implements corrective action for quality deficiencies.

Section Supervisors & Team Leaders. Responsible for applying the requirements of the Quality System to their operation and assuring the staff applies all system requirements. Initiates, designs, documents, and implements corrective action for quality deficiencies.

Quality Assurance Officers. Responsible for design support, implementation support, training, and monitoring support for the quality system. Conducts audits and product reviews to identify product, process, or operational defects using statistical monitoring tools and processes audits for elimination via corrective action. Provides support for implemented corrective actions for compliance. Serves as the primary alternate in the absence of the Quality Assurance Director.

Bench Analysts. Responsible for applying the requirements of the Quality System to the analyses they perform, evaluating QC data and initiating corrective action for quality control deficiencies within their control. Implements global corrective action as directed by superiors.

3.2 ***Program Authority***. Authority for program implementation originates with the Board of Directors who bears the ultimate responsibility for system design, implementation, and enforcement of requirements. This authority and responsibility is delegated to the Director of Quality Assurance who performs quality functions independently without the encumbrances or biases associated with operational or production responsibilities to ensure an honest, independent assessment of quality issues.

3.3 ***Data Integrity Policy***: The SGS Accutest Inc. Data Integrity Policy reflects a comprehensive, systematic approach for assuring that data produced by the laboratory accurately reflects the outcome of the tests performed on field samples and has been produced in a bias free environment by ethical professionals. The policy includes a commitment to technical ethics, staff training in ethics and data integrity, an individual attestation to data integrity and procedures for evaluating data integrity. Senior management assumes the responsibility for assuring compliance with all technical ethics elements and operation of all data integrity procedures. The staff is responsible for compliance with the ethical code of conduct and for practicing data integrity procedures.

The SGS Accutest Inc. Data Integrity Policy is as follows:

"SGS Accutest Inc. is committed to producing data that meets the data integrity requirements of the environmental regulatory community. This commitment is demonstrated through the application of a comprehensive data integrity program that includes ethics and data integrity training, data integrity evaluation procedures, staff participation and management oversight. Adherence to the specifications of the program assures that data provided to our clients is of the highest possible integrity and can be used for decision making processes with high confidence."

Data Integrity Responsibilities

Management. Senior management retains oversight responsibility for the data integrity program and retains ultimate responsibility for execution of the data integrity program elements. Senior management is responsible for providing the resources required to conduct ethics training and operate data integrity evaluation procedures. They also include responsibility for creating an environment of trust among the staff and being the lead advocate for promoting the data integrity policy and the importance of technical ethics. The Quality Assurance Director is the designated ethics officer for the Company.

Staff. The staff is responsible for adhering to the company ethics policy as they perform their duties and responsibilities associated with sample analysis and reporting. By executing this responsibility, data produced by SGS Accutest Inc. retains its high integrity characteristics and withstands the rigors of all data integrity checks.

The staff is also responsible for adhering to all laboratory requirements pertaining to manual data edits, data transcription and data traceability. These include the application of approved manual peak integration and documentation procedures. It also includes establishing traceability for all manual results calculations and data edits.

Ethics Statement. The SGS Accutest Inc. ethics statement reflects the standards that are expected for businesses that provide environmental services to regulated entities and regulatory agencies on a commercial basis. The Ethics Policy is comprised of key elements that are essential to organizations that perform chemical analysis for a fee. As such, it focuses on elements related to personal, technical and business activities.

SGS Accutest Inc. provides analytical chemistry services on environmental matters to the regulated community. The data the company produces provides the foundation for determining the risk presented by a chemical pollutant to human health and the environment. The environmental industry is dependent upon the accurate portrayal of environmental chemistry data. This process is reliant upon a high level of scientific and personal ethics.

It is essential to the Company that each employee understands the ethical and quality standards required to work in this industry. Accordingly, SGS Accutest Inc. has adopted a code of ethics, which each employee is expected to adhere to as follows:

- Perform chemical and microbiological analysis using accepted scientific practices and principles.
- Perform tasks in an honest, principled and incorruptible manner inspiring peers & subordinates.
- Maintain professional integrity as an individual.
- Provide services in a confidential, honest, and forthright manner.
- Produce results that are accurate and defensible.
- Report data without any considerations of self-interest.
- Comply with all pertinent laws and regulations associated with assigned tasks and responsibilities.

Data Integrity Procedures. Four key elements comprise the SGS Accutest Inc. data integrity system. Procedures have been implemented for conducting data integrity training and for documenting that employees conform to the SGS Accutest Inc. Data Integrity and Ethics policy.

The data integrity program consists of routine data integrity evaluation and documentation procedures to periodically monitor and document data integrity. These procedures are documented as SOPs. SOPs are approved and reviewed annually following the procedures employed for all SGS Accutest Inc. SOPs. Documentation associated with data integrity evaluations is maintained on file and is available for review.

Data Integrity Training. SGS Accutest Inc. employees receive technical ethics training during new employee orientation. Employees are also required to refresh their ethical conduct agreement annually, which verifies their understanding of SGS Accutest Inc. ethics policy and their ethical responsibilities. A brochure summarizing the details of the SGS Accutest Inc. Data Integrity Policy is distributed to all employees with the Ethical Conduct Agreement. The refreshed agreement is appended to each individual's training file.

The training focuses on the reasons for technical ethics training, explains the impact of data fraud on human health and the environment, and illustrates the consequences of criminal fraud on businesses and individual careers. SGS Accutest Inc. ethics policy and code of ethics are reviewed and explained for each new employee.

Training on data integrity procedures are conducted by individual departments for groups involved in data operations. These include procedures for manual chromatographic peak integration, traceability for manual calculations and data transcription.

Data Integrity Training Documentation. Records of all data integrity training are maintained in individual training folders. Attendance at all training sessions is documented and maintained in the training archive.

SGS Accutest Inc. Data Integrity and Ethical Conduct Agreement. All employees are required to sign a Data Integrity and Ethical Conduct Agreement annually. This document is archived in individual training files, which are retained for duration of employment.

The Data Integrity and Ethical Conduct Agreement are as follows**:**

I. *I understand the high ethical standards required of me with regard to the duties I perform and the data I report in connection with my employment at SGS Accutest Inc.*

II. *I have received formal instruction on the code of ethics that has been adapted by SGS Accutest Inc. during my orientation and agree to comply with these requirements.*

III. *I have received formal instruction on the elements of SGS Accutest Inc. Data Integrity Policy and have been informed of the following specific procedures:*

   a. *Formal procedures for the confidential reporting of data integrity issues are available, which can be used by any employee,*

   b. *A data integrity investigation is conducted when data issues are identified that may negatively impact data integrity.*

c. *Routine data integrity monitoring is conducted on sample data, which may include an evaluation of the data I produce,*

IV. *I have read the brochure detailing SGS Accutest Inc. Data Integrity and Ethics Program as required.*

V. *I am aware that data fraud is a punishable crime that may include fines and/or imprisonment upon conviction.*

VI. *I also agree to the following:*

a. *I shall not intentionally report data values, which are not the actual values observed or measured.*

b. *I shall not intentionally modify data values unless the modification can be technically justified through a measurable analytical process.*

c. *I shall not intentionally report dates and times of data analysis that are not the true and actual times the data analysis was conducted.*

d. *I shall not condone any accidental or intentional reporting of inauthentic data by other employees and immediately report it's occurrence to my superiors.*

e. *I shall immediately report any accidental reporting of inauthentic data by myself to my superiors.*

Data Integrity Monitoring. Documented procedures are employed for performing data integrity monitoring. These include regular data review procedures by supervisory and management staff (Section 12.7), supervisory review and approval of manual integrations and periodic reviews of GALP audit trails from the LIMS and all computer controlled analysis.

Data Review. All data produced by the laboratory undergoes at least two levels of review the final review must be performed by a manager, supervisor or designated reviewer. Detected data anomalies that appear to be related to data integrity issues are isolated for further investigation. The investigation is conducted following the procedures described in this section.

Manual Peak Integration Review and Approval. Routine data review procedures for all chromatographic processes includes a review of all manual chromatographic peak integrations. This review is performed by the management staff and consists of a review of the machine integration compared to the manual integration. Manual integrations, which have been performed in accordance with SGS Accutest Inc. manual peak integration procedures, are approved for further processing and release. Identification of samples and analytes in which manual integration had been necessary may be recorded in a report case narrative specific to a particular client and project requirement.

Manual integrations which are not performed to SGS Accutest Inc. specifications are set aside for corrective action, which may include analyst retraining or further investigation as necessary.

Data Integrity Review. Data integrity audits are comprehensive data package audits that include a review of raw data, process logbooks, processed data reports and GALP audit trails from individual instruments and LIMS. GALP audit trails, which record all electronic data activities, are available for the majority of computerized methodology and the laboratory information management system (LIMS). These audit trails are periodically reviewed to determine if interventions performed by technical staff constitute an appropriate action. The review is performed on a recently completed job and may include interviews with the staff who performed the analysis. Findings indicative of inappropriate interventions or data integrity issues are investigated to determine the cause and the extent of the anomaly.

Confidential Reporting of Data Integrity Issues. Data integrity concerns may be raised by any individual to their supervisor. Employees with data integrity concerns should always discuss those concerns with their immediate supervisors as a first step unless the employee is concerned with the confidentiality of disclosing data integrity issues or is uncomfortable discussing the issue with their immediate supervisors. The supervisor makes an initial assessment of the situation to determine if the concern is related to a data integrity violation. Those issues that appear to be violations are documented by the supervisor and referred to the Director of Quality Assurance for investigation.

Documented procedures for the confidential reporting of data integrity issues in the laboratory are part of the data integrity policy. These procedures assure that laboratory staff can privately discuss ethical issues or report items of ethical concern without fears of repercussions with senior staff.

Employees with data integrity concerns that they consider to be confidential are directed to the Corporate Human Resources Manager in Dayton, New Jersey. The HR Manager acts as a conduit to arrange a private discussion between the employee and the Corporate QA Director or a local QA Officer.

During the employee - QA discussion, the QA representative evaluates the situation presented by the employee to determine if the issue is a data integrity concern or a legitimate practice. If the practice is legitimate, the QA representative clarifies the process for the employee to assure understanding. If the situation appears to be a data integrity concern, the QA representative initiates a Data Integrity Investigation following the procedures specified in SOP EQA059.

Data Integrity Investigations. Follow-up investigations are conducted for all reported instances of ethical concern related to data integrity. Investigations are performed in a confidential manner by senior management according to a documented procedure. The outcome of the investigation is documented and reported to the company president who has the ultimate responsibility for determining the final course of action in the matter. Investigation documentation includes corrective action records, client notification information and disciplinary action outcomes, which is archived for a period of five years.

The investigations are conducted by the senior staff and supervisory personnel from the affected area. The investigations team includes the Laboratory Director and the Quality Assurance Director. Investigations are conducted in a confidential manner until it is completed and resolved.

The investigation includes a review of the primary information in question by the investigations team. The team performs a review of associated data and similar historical data to determine if patterns exist. Interviews are conducted with key staff to determine the reasons for the observed practices.

Following data compilation, the investigations team reviews all information to formulate a consensus conclusion. The investigation results are documented along with the recommended course of action.

Corrective Action, Client Notification & Discipline. Investigations that reveal systematic data integrity issues will be referred for corrective action, resolution and disposition (Section 13). If the investigation indicates that an impact to data has occurred and the defective data has been released to clients, client notification procedures will be initiated following the steps in Section 18.7.

In all cases of data integrity violations, some level of disciplinary action will be conducted on the responsible individual. The level of discipline will be consistent with the violation and may range from retraining and/or verbal reprimand to termination. A zero tolerance policy is in effect for unethical actions.

4.0 JOB DESCRIPTIONS OF KEY STAFF

4.1 ***Requirement***: Descriptions of key positions within the organization are defined to ensure that clients and staff understand duties and the responsibilities of the management staff and the reporting relationships between positions.

President/CEO. Responsible for overall process improvement for all business processes. Is also responsible for Quality Assurance, IT Development and Health and Safety. Reports directly to the Board of Directors.

Laboratory Director. Reports to the company President/CEO. Establishes laboratory operations strategy. Direct supervision of client services, organic chemistry, inorganic chemistry, field services, and sample management. Maintains operational responsibility for the designated regional laboratories as defined in the SGS Accutest Inc. Organization Chart. Assumes the responsibilities of the CEO in his absence.

Vice President, Chief Information Officer. Reports to President/CEO. Develops IT Software and hardware agenda. Provides system strategies to compliment company objectives. Maintains all software and hardware used for data handling.

Vice President, Chief Financial Officer. Reports to the company President /CEO. Responsibilities include overseeing the Financial Accounting and Human Resource Department, Corporate Purchasing, Corporate IT Help Desk, and Salary and Benefit Administration.

Director, Quality Assurance. Reports to the company President/CEO and functions independently from laboratory operations. Establishes the company quality agenda, develops quality procedures, provides assistance to operations on quality procedure implementation, coordinates all quality control activities, monitors the quality system, and provides quality system feedback to management to be used for process improvement. Assumes the responsibilities of the Laboratory Director in the absence of the Laboratory Director and the President/CEO.

Director Client Services. Reports to the Laboratory Director. Establishes and maintains communications between clients and the laboratory pertaining to client requirements which are related to sample analysis and data deliverables. Initiates client orders and supervises sample login operations.

Manager, Organics (Organics Technical Director). Reports to the laboratory director. Directs the operations of the organics group, consisting of organics preparation and instrumental analysis. Establishes daily work schedule. Supervises method implementation, application, and data production. Responsible for following Quality System requirements. Maintains laboratory instrumentation in an operable condition. Assumes the responsibilities of the Laboratory Director in his absence.

Manager, Inorganics (Inorganics Technical Director). Reports to the laboratory director. Directs the operations of the inorganics group, consisting of wet chemistry and the metals laboratories. Establishes daily work schedule. Supervises method implementation, application, and data production. Responsible for following Quality System requirements. Maintains laboratory instrumentation in an operable condition. Assumes the responsibilities of the Laboratory Director in his absence.

Manager, Field Services. Reports to the laboratory director. Conducts field sampling and analysis of "analyze immediately" parameters in support of ongoing field projects. Responsible for proper collection, preservation, documentation and shipment of field samples. Maintains field sampling and field instrumentation required to perform primary responsibilities.

Manager, Sample Management. Reports to the laboratory director. Develops, maintains and executes all procedures required for receipt of samples, verification of preservation, and chain of custody documentation. Responsible for maintaining and documenting secure storage, delivery of samples to laboratory units on request and courier services.

Director, Environmental Health and Safety. Reports to the President/CEO. Responsible for developing company safety program and chemical hygiene plan. Reviews and updates these plans annually. Responsible for employee training on relevant health and safety topics. Documents employee training. Manages laboratory waste management program.

Manager, Wet Chemistry. Reports to the Lab Director. Executes daily analysis schedule. Supervises the analysis of samples for wet chemistry parameters using valid, documented methodology. Maintains instrumentation in an operable condition. Reviews data for compliance to quality and methodological requirements. Assumes the responsibilities of the Inorganics Manager in his absence.

Manager, Metals. Reports to the Lab Director. Executes daily analysis schedule. Supervises the analysis of samples for metallic elements using valid, documented methodology. Documents all procedures and data production activities. Maintains instrumentation in an operable condition. Reviews data for compliance to quality and methodological requirements.

Manager, Organic Preparation. Reports to the Lab Director. Executes the daily sample preparation schedule. Performs the extract of multi-media samples for organic constituents using valid, documented methodology. Prepares documentation for extracted samples. Assumes custody until transfer for analysis.

Technical Support Supervisor, Organics. Reports to the organic manager. Oversees all instrument maintenance and new equipment installation. Conducts method development and implementation tasks.

Manager, Semi VOA. Reports to the Lab Director. Expedites the analysis of samples and sample extracts. Executes daily analysis schedule. Supervises the analysis of samples for organic parameters using valid, documented methodology. Documents all data and data production activities. Maintains instrumentation in an operable condition. Reviews data for compliance to quality and methodological requirements. Assumes the responsibilities of the Organics Manager in his absence.

Supervisor, Report Generation. Reports to the organics manager. Compiles raw and processed sample data and assembles into client-ready reports. Initiates report scanning for archiving purposes. Maintains raw batch data in accessible storage. Mails completed reports to clients according to specified report turnaround schedule.

Quality Assurance Officers. Reports to the Director, Quality Assurance. Performs quality control data review for trend monitoring purposes. Conducts internal audits and prepares reports for management review. Oversees proficiency testing program. Process quality control data for statistical purposes. Assumes the responsibilities of the Quality Assurance Director in his absence.

4.2 ***Employee Screening, Orientation, and Training***.

All potential laboratory employees are screened and interviewed by human resources and technical staff prior to their hire. The pre-screen process includes a review of their qualifications including education, training and work experience to verify that they have adequate skills to perform the tasks of the job.

Newly hired employees receive orientation training beginning the first day of employment by the Company. Orientation training consists of initial health and safety training including general laboratory safety, personal protection and building evacuation. Orientation also includes quality assurance program training, data integrity training, and an overview of the Company's goals, objectives, mission, and vision.

All technical staff receives training to develop and demonstrate proficiency for the methods they perform. New analysts work under supervision until the supervisory staff is satisfied that a thorough understanding of the method is apparent and method proficiency has been demonstrated, through a precision and accuracy study that has been documented, reviewed and approved by the QA Staff. Data from the study is compared to method acceptance limits. If the data is unacceptable, additional training is required. The analyst may also demonstrate proficiency by producing acceptable data through the analysis of an independently prepared proficiency sample.

Individual proficiency is demonstrated annually for each method performed. Data from initial and continuing proficiency demonstrations are archived in the individual's training folder.

4.3 ***Training Documentation***. The human resources department prepares a training file for every new employee. All information related to qualifications, experience, external training courses, and education are placed into the file. Verification documentation for orientation, health & safety, quality assurance, and ethics training is also included in the file.

Additional training documentation is added to the file as it is developed. This includes documentation of SOP understanding, data for initial and continuing demonstrations of proficiency, performance evaluation study data and notes and attendance lists from group training sessions.

The Quality Assurance Department maintains the employee training database. This database is a comprehensive inventory of training documentation for each individual employee. The database enables supervisors to obtain current status information on training data for individual employees on a job specific basis. It also enables the management staff to identify training documentation in need of completion.

Employee specific database records are created by human resources on the date of hire. Data base fields for job specific requirements such as SOP documentation of understanding and annual demonstration of analytical capability are automatically generated when the supervisor assigns a job responsibility. Employees acknowledge that their SOP responsibilities have been satisfied using a secure electronic process which updates the database record. Reports are produced which summarize the qualifications of individual employees or departments.

5.0 SIGNATORY APPROVALS

Requirement: Procedures have been developed for establishing the traceability of data and documents. The procedure consists of a signature hierarchy, indicating levels of authorization for signature approvals of data and information within the organization. Signature authority is granted for approval of specific actions based on positional hierarchy within the organization and knowledge of the operation that requires signature approval. SOP EQA032 Signature Authority explains the process of SGS Accutest Inc. Signature Authority and the use of electronic signatures in the laboratory. A log of signatures and initials of all employees is maintained by the QA Staff for cross-referencing purposes.

5.1 ***Signature Hierarchy***.

President/CEO. Approval of quality assurance policy in lieu of the Director, Quality Assurance. IT Development and Health and Safety purchase approvals in Lieu of IT and H & S managers.

Laboratory Director. Approval of final reports in the absence of the President. Approval of SOPs, project specific QAPs, data review and approval in lieu of technical managers. Establishes and implements technical policy.

Vice President, Chief Information Officer. Department specific supplies purchase. MIS policy.

Director, Quality Assurance. Approval of final reports and quality assurance policy in the absence of the President. Approval of SOPs, project specific QAPs, data review and approval in lieu of technical managers.

Director, Client Services. QAP and sampling and analysis plan approval. Project specific contracts, pricing, and price modification agreements. Approval and acceptance of incoming work, Client services policy.

Managers, Technical Departments. Methodology and department specific QAPs. Data review and approval, department specific supplies purchase. Technical approval of SOPs.

Manager, Sample Management. Initiation of laboratory sample custody and acceptance of all samples. Approval of department policies and procedures. Department specific supplies purchase.

Director, Environmental Health & Safety. Approval of health and safety policy in the absence of the President. Approval of health and safety SOPs. Waste manifesting and approval.

Assistant Managers: Technical Departments. Data review approval, purchasing of expendable supplies.

Supervisor, Field Services. Sampling plan design and approval. Data review for field parameters. State form certification. Department policies and procedures. Department specific supplies purchase.

Supervisors, Technical Departments. Data review approval, purchasing of expendable supplies.

5.2 ***Signature Requirements***. All laboratory activities related to sample custody and generation or release of data must be approved using either initials, signatures or electronic, password protected procedures. The individual, who applies his signature initial or password to an activity or document, is authorized to do so within the limits assigned to them by their supervisor. All written signatures and initials must be applied in a readable format that can be cross-referenced to the signatures and initials log if necessary.

5.3 ***Signature and Initials Log***. The QA group maintains a signature and initials log. New employee signatures and initials are appended to the log on the first day of employment. Signature of individuals no longer employed by the company are retained, but annotated with their date of termination.

5.4 ***Electronic Signature Log.*** Key technical staff will sign a liability document for their signatures designating the use of their electronic signatures on an annual basis. Quality Assurance team keeps a wet copy of these signatures on form QA115.

6.0 DOCUMENTATION & DOCUMENT CONTROL

Requirement: Document control policies have been established which specify that any document used as an information source or for recording analytical or quality control information must be managed using defined document control procedures. Accordingly, policies and procedures required for the control, protection, and storage of any information related to the production of analytical data and the operation of the quality system to assure its integrity and traceability have been established and implemented in the laboratory. The system contains sufficient controls for managing, archiving and reconstructing all process steps which contributed to the generation of an analytical test result. Using this system, an audit trail for reported data can be produced, establishing complete traceability for the result.

6.1 ***Administrative Records***. Administrative (non-analytical) records are managed by the quality assurance department. These records consist of electronic documents which are retained in a limited access electronic directory or paper documents, which are released to the technical staff upon specific request.

Form Generation, Modification & Control. The quality assurance group approves and manages all forms used as either stand-alone documents or in logbooks to ensure their traceability. Forms are generated as computer files only and are maintained in a limited access master directory. The QA staff also manages and approves modifications to existing forms. Obsolete editions of modified forms are retained for seven years.

Approved forms are assigned a 5-character alphanumeric code. The first two alpha characters designate the department that uses the form; the next three digits are sequentially assigned number.

New forms must include the name SGS Accutest Inc. and appropriate spaces for signatures of approval and dates. Further design specifications are the responsibility of the originating department.

The technical staff is required to complete all forms to the maximum extent possible. If information for a specific item is unavailable, the analyst is required to "Z" the information block. The staff is also required to "Z" the uncompleted portions of a logbook or logbook form if the day's analysis does not fill the entire page of the form.

Logbook Control. All laboratory logbooks are controlled documents that are comprised of approved forms used to document specific processes. New logs are numbered and issued to a specific individual who is assigned responsibility for the log. Old logs are returned to QA for entry into the document archive system where they are retained for seven (7) years. Laboratory staff may hold a maximum of two consecutively dated logbooks of the same type in the laboratory including the most recently issued book to simplify review of recently completed analysis. The Organic prep department maintains multiple active copies of prep logbooks to facilitate production.

Controlled Documents. Key laboratory documents that are distributed internally and externally are numbered for tracking purposes. Individuals receiving documents, who must be informed when changes occur, receive controlled copies of those documents. Controlled status simplifies document updates and retrieval of outdated documents. Control is maintained through a document numbering procedure and document control logbook which identifies the individual receiving the controlled document and the date of receipt. Key documents are also distributed as uncontrolled documents if the recipient does not require updated copies when changes occur. Key documents in uncontrolled status are numbered and tracked using the same procedures as controlled documents.

Quality Systems Manual (QSM). All QSMs are assigned a number prior to distribution. The number, date of distribution, and identity of the individual receiving the document are recorded in the document control logbook. The numbering system is restarted with each new volume, which corresponds to the annual revision of the QSM. Electronic versions are distributed as read only files that are password protected.

Standard Operating Procedures (SOPs). SOPs are maintained by pre-designating the numbers of official copies of documents that are placed into circulation within the laboratory. Official documents are copied to green paper and placed into the appropriate laboratory section as follows:

Administrative: One master copy for the administrative file.

Sample Management: One controlled green copy for the sample management file.

Organics Laboratories: Two controlled green copies, one for the affected laboratory area, and one for the organics laboratory file.

Inorganics Laboratories: Two controlled green copies, one for the affected laboratory area, and one for the inorganics laboratory file.

Field Services: One controlled green copy for each field sampling team (generally a single field technician).

The original, signed copy of the SOP is maintained in the master SOP binder by the QA staff. The QA staff collects outdated versions of SOPs as they are replaced and archived for a period of seven (7) years in the QA archives. Electronic versions of outdated SOPs are moved from the active SOP directory to the inactive directory.

6.2 ***Technical Records***. All records related to the analysis of samples and the production of an analytical result are archived in secure document storage or on electronic media and contain sufficient detail to produce an audit trail which re-creates the analytical result. These records include information related to the original client request, bottle order, sample login and custody, storage, sample preparation, analysis, data review and data reporting.

Each department involved in this process maintains controlled documents which enable them to maintain records of critical information relevant to their department's process.

6.3 ***Quality Control Support Data & Records***. All information and data related to the quality system is stored in a restricted access directory on the network server. Information on this directory is backed-up daily. Users of the quality assurance information and data have "read-only" access to the files contained in the directory. The QA staff and the laboratory director have write capability in this directory.

This directory contains all current and archived quality system manuals, SOPs, control limits, MDL studies, precision and accuracy data, official forms, internal audit reports, proficiency test scores and metrics calibration information.

The following information is retained in the directory:

Quality System Manuals
Standard Operating Procedures
ASTM & NIST Methods
Bottleware & Preservative QC Data
Certification Documentation
Change Management Data
External Audit Reports
Internal Audit Reports
Corrective Action Database
Laboratory Forms Directory
Health & Safety Manuals
Inactive Standard Operating Procedures
Method Detection Limit Data
Metrics Inventory & Calibration Data
Performance Limits
Proficiency Test Scores & Statistics
Project Specific Analytical Requirements
QC Report Reviews
Regulatory Agency Quality Documents
Staff Bios And Job Descriptions
State Specific Methods

6.4 ***Analytical Records***. All data related to the analysis of field samples are retained as either paper or electronic records that can be retrieved to compile a traceable audit trail for any reported result. All information is linked to the client job and sample number, which serves as a reference for all sample related information tracking.

Critical times in the life of the sample from collection through analysis to disposal are documented. This includes date and time of collection, receipt by the laboratory, preparation times and dates, analysis times and dates and data reporting information. Analysis times are calculated in hours for methods where holding time is specified in hours (≤72 hours).

Sample preparation information is recorded in a separate controlled logbook. It includes sample identification numbers, types of analysis, preparation and cleanup methods, sample weights and volumes, reagent lot numbers and volumes and any other information pertinent to the preparation procedure.

Information related to the identification of the instrument used for analysis is permanently attached to the electronic record. The record includes an electronic data file that indicates all instrument conditions employed for the analysis, including the type of analysis conducted. The

analyst's identification is electronically attached to the record. The instrument tuning and calibration data is electronically linked to the sample or linked though paper logs which were used in the documentation of the analysis. Quality control and performance criteria are permanently linked to the paper archive or electronic file.
Paper records for the identity, receipt, preparation and evaluation of all standards and reagents used in the analysis are documented in prepared records and maintained in controlled documents or files. Lot number information linking these materials to the analysis performed is recorded in the logbooks associated with the samples in which they were used.

Manual calculations or peak integrations that were performed during the data review are retained as paper or scanned documents and included as part of the electronic archive. Signatures for data review are retained on paper or as scanned versions of the paper record for the permanent electronic file.

6.5 ***Confidential Business Information (CBI).*** Operational documents including SOPs, Quality Manuals, personnel information, internal operations statistics, and laboratory audit reports are considered confidential business information. Strict controls are placed on the release of this information to outside parties.

Release of CBI to outside parties or organizations may be authorized upon execution of a confidentiality agreement between SGS Accutest Inc. and the receiving organization or individual. CBI information release is authorized for third party auditors and commercial clients in electronic mode as Adobe Acrobat .PDF format only.

6.6 ***Software Change Documentation & Control.*** Changes to software are documented as text within the code of the program undergoing change. Documentation includes a description of the change, reason for change and the date the change was placed into effect. Documentation indicating the adequacy of the change is prepared following the evaluation by the user who requested the change.

6.7 ***Report and Data Archiving*.** SGS Accutest Inc. produces digital files of all raw and processed data which is maintained for a minimum period of seven (7) years. The archived files consist of all raw data files and source documents associated with the analysis of field samples and proficiency test samples. Data files and source documents associated with method calibration and project and method quality control are also archived. After seven years, the files may be discarded unless contractual arrangements exist which dictate different requirements. Client or regulatory agency specific data retention practices are employed for several government organizations such as the Department of Defense and the Massachusetts Department of Environmental Protection that require a retention period of ten (10) years. Data archiving may also be extended up to ten (10) years for specific commercial clients in response to contractual requirements.

Complete date and time stamped PDF reports are generated automatically from the laboratory information management system (LIMS) using the source documents archived on the document server. These source documents are maintained on a document server and archived to primary and clone tapes. The primary tapes remain on premises while the clone tapes are taken to a secure offsite location for permanent storage. Both the primary and clone tapes remain in storage for the remainder of the archive period.

6.8 ***Training***. The company maintains a training record for all employees that documents that they have received instruction on administrative and technical tasks that are required for the job they perform. Training records for individuals employed by the company are retained for a period of six months following their termination of employment.

Training File Origination. The Human Resources Group (HR) initiates training files. The QA staff, through the Quality Assurance officer, retains the responsibility for the maintenance and tracking of all training related documentation in the file. The file is begun on the first day of employment. Information required for the file includes a copy of the individual's most current resume, detailing work experience and a copy of any college diplomas and transcript(s). Information added on the first day includes documentation of health and safety training, quality assurance training and a signed data integrity training and ethical conduct agreement.

Training documentation, training requirements, analyst proficiency information and other training related support documentation is tracked using a customized database application (Section 4.3). Database extracts provide an itemized listing of specific training requirements by job function. Training status summaries for individual analysts portray dates of completion for job specific training requirements.

6.9 ***Technical Training***. The supervisor of each new employee is responsible for developing a training plan for each new employee. The supervisor evaluates the employees training progress at regular frequencies. Supporting documentation, including demonstration of capability and precision and accuracy studies, which demonstrate an analyst's proficiency for a specific test, are added to the training file as completed. Employees and supervisors verify documentation of understanding (DOU) for all assigned standard operating procedures in the training database. Certificates or diplomas for any off-site training are also added to the file.

7.0 REFERENCE STANDARD TRACEABILITY

Requirement: Documented procedures, which establish traceability between any measured value and a national reference standard, are established by the laboratory as required. All metric measurements are traceable to NIST reference weights or thermometers that are calibrated on a regular schedule. All chemicals used for calibration of a quantitative process are traceable to an NIST reference that is documented by the vendor using a certificate of traceability. The laboratory maintains a documentation system that establishes the traceability links. The procedures for verifying and documenting traceability are documented in standard operating procedures.

7.1 ***Traceability of Metric Measurements - Thermometers***. SGS Accutest Inc. uses NIST thermometers to calibrate commercially purchased thermometers prior to their use in the laboratory and annually thereafter for liquid in glass thermometers or quarterly for electronic temperature measuring devices. If necessary, thermometers are assigned correction factors that are determined during their calibration using an NIST thermometer as the standard. The correction factor is documented in a thermometer calibration database and on a tag attached to the thermometer. The correction factor is applied to temperature measurements before recording the measurement in the temperature log. Calibration of each thermometer is verified and documented on a regular schedule. The NIST thermometer is checked for accuracy by an ISO 17025 approved vendor every five (5) years following the specifications for NIST thermometer calibration verification detailed in the united States Environmental Protection Agency's "Manual for the Certification of Laboratories Analyzing Drinking Water", Fifth Edition, February2005.

7.2 ***Traceability of Metric Measurements – Calibration Weights***. SGS Accutest Inc. uses calibrated weights, which are traceable to NIST standard weights to calibrate all balances used in the laboratory. Balances are calibrated to specific tolerances within the intended use range of the balance. Calibration checks are required on each day of use. If the tolerance criteria are not achieved, corrective action specified in the balance calibration SOP is applied before the balance can be used for laboratory measurements. Recalibration of all calibration weights is conducted and documented on a biannual basis.

7.3 ***Traceability of Chemical Standards***. All chemicals, with the exception of bulk dry chemicals and acids, purchased as reference standards for use in method calibration must establish traceability to NIST referenced material through a traceability certificate. Process links are established that enable a calibration standard solution to be traced to its NIST reference certificate.

Chemical standards used for analysis must meet the purity specifications of the method. These specifications must be stated in the reagents section of the method SOP.

7.4 ***Assignment of Reagent, Bulk Chemical and Standard Expiration Dates.*** Expiration date information for all purchased standards, prepared standard solutions and selected reagents is provided to SGS Accutest Inc. by the vendor as a condition of purchase. Neat materials, bulk chemicals including solvents, acids and inorganic reagents are not required to be purchased with expiration dates. An expiration date of five (5) years from the date of receipt shall be established. Prepared solutions are labeled with the expiration date provided by the manufacturer. In-house prepared solutions are assigned expiration dates that are consistent with the method that employs their use unless documented experience indicates that an alternate date can be applied. If alternate expiration dates are employed, their use is documented in the method SOP. Expiration dates for prepared inorganic reagents, which have not exhibited instability, are established at two years from the date of preparation for tracking purposes.

The earliest expiration date has been established as the limiting date for assigning expiration dates to prepared solutions. The assignments of expiration dates that are later than the expiration date of any derivative solution or material are prohibited.

7.5 ***Documentation of Traceability***. Traceability information is documented in individual logbooks designated for specific measurement processes. The quality assurance group maintains calibration documentation for metric references in separate logbooks.

Balance calibration verification is documented in logbooks that are assigned to each balance. The individual conducting the calibration is required to initial and date all calibration activities. Any defects that occur during calibration are also documented along with the corrective action applied and a demonstration of return to control. Annual service reports and certificates are retained on file by the QA staff.

Temperature control is documented in logbooks or an electronic temperature monitoring database assigned to the equipment being monitored. A calibrated thermometer or probe is assigned to each individual item. Uncorrected and corrected measurements are recorded. Logbooks document with the date and initials of the individual conducting the measurement on a daily or as used basis. The temperature database records temperatures automatically every 15 minutes. Corrective action, if required, is also documented including the demonstration of return to control.

Initial traceability of chemical standards is documented via a vendor-supplied certificate (not available for bulk dry chemicals and acids) that includes lot number, expiration date and certified concentration information. Solutions prepared using the vendor supplied chemical standards are documented in logbooks assigned to specific analytical processes. Alternatively, documentation may be entered into the electronic standards and reagent tracking log. The documentation includes links to the vendor's lot number, an internal lot number, and dates of preparation, expiration date, and the preparer's initials.

SGS Accutest Inc. employs commercially prepared standard solutions whose traceability can be demonstrated through a vendor supplied certificate of analysis that includes an experimental verification of the standard's true concentration. The test value for the verification analysis must agree within 1% of the vendor's true value before it can be employed for calibration purposes. If the test value differs from the nominal value by more than 1%, then the test value is used as the true value in laboratory calibrations and calculations. Purchased standards which do not have a certificate of analysis cannot be used for calibration or calibration verification purposes and are rejected or returned to the vendor.

Supervisors conduct regular reviews of logbooks, which are verified using a signature and date.

8.0 TEST PROCEDURES, METHOD REFERENCES, AND REGULATORY PROGRAMS

Requirements: The laboratory employs client specified or regulatory agency approved methods for the analysis of environmental samples. A list of active methods is maintained, which specifies the type of analyses performed and cross-references the methods to applicable environmental regulations. Routine procedures used by the laboratory for the execution of a method are documented in standard operating procedures. Method performance and sensitivity are demonstrated annually where required. Defined procedures for the use of method sensitivity limits for data reporting purposes are established by the Director of Quality Assurance and used consistently for all data reporting purposes.

8.1 ***Method Selection & Application***. SGS Accutest Inc. employs methods for environmental sample analysis that are consistent with the client's application, which are appropriate and applicable to the project objectives. SGS Accutest Inc. informs the client if the method proposed is inappropriate or outdated and suggests alternative approaches.

SGS Accutest Inc. employs documented, validated regulatory methods in the absence of a client specification and informs the client of the method selected. These methods are available to the client and other parties as determined by the client. Documented and validated in-house methods may be applied if they are appropriate to the project. The client is informed of the method selection.

8.2 ***Standard Operating Procedures***. Standard operating procedures (SOP) are prepared for routine methods executed by the laboratory, processes related to laboratory operations and sample or data handling. All SOPs are formatted to meet the specifications established by the National Environmental Laboratory Accreditation Conference, which are detailed in Chapter Five – Quality Systems of the established Standards. The procedures describe the process steps in sufficient detail to enable an individual, who is unfamiliar with the procedure to execute it successfully.

SOPs are evaluated annually and edited if necessary. Reviewed SOPs that do not require modification include an evaluation summary form indicating that an evaluation was conducted and modifications were not needed. SOPs can be edited on a more frequent basis if changes are required for any reason. These may include a change to the methodology, elimination of systematic errors that dictate a need for process changes or modifications to incorporate a new version of the method promulgated by the originating regulatory agency. Procedural modifications are indicted using a revision number. SOPs are available for client review at the SGS Accutest Inc. facility upon request.

The complete list of the laboratories SOPs available as of the date of publication of this QSM version are detailed in Appendix II.

8.3 ***Method Validation***. Standard methods from regulatory sources are primarily used for all analysis. Standard methods do not require validation by the laboratory. Non-standard, in-house methods are validated prior to use. Validation is also performed for standard methods applied outside their intended scope of use. Validation is dependent upon the method application and may include analysis of quality control samples to develop precision and accuracy information for the intended use. A final method validation report is generated, which includes all data in the validation study. A statement of adequacy and/or equivalency is included in the report. A copy of the report is archived in the quality assurance directory of the company server.

Non-standard methods are validated prior to use. This includes the validation of modified standard methods to demonstrate comparability with existing methods. Demonstrations and validations are performed and documented prior to incorporating technological enhancements and nonstandard methods into existing laboratory methods used for general applications. The demonstration includes method specific requirements for assuring that significant performance differences do not occur when the enhancement is incorporated into the method. Validation is dependent upon method application and may include the analysis of quality control samples to develop precision and accuracy information for intended use.

The study procedures and specifications for demonstrating validation include comparable method sensitivity, calibration response, method precision; method accuracy and field sample consistency for several classes of analytical methods are detailed in this document. These procedures and specifications may vary depending upon the method and the modification.

8.4 ***Estimated Uncertainty.*** A statement of the estimated uncertainty of an analytical measurement accompanies the test result when required. Estimated uncertainty is derived from the performance limits established for spiked samples of similar matrices. The degree of uncertainty is derived from the negative or positive bias for spiked samples accompanying a specific parameter. When the uncertainty estimate is applied to a measured value, the possible quantitative range for that specific parameter at that measured concentration is defined. Well recognized regulatory methods that specify values for the major sources of uncertainty and specify the data reporting format do not require a further estimate of uncertainty.

8.5 ***Demonstration of Capability***. Confirmation testing is conducted to demonstrate that the laboratory is capable of performing the method before its application to the analysis of environmental samples. The results of the demonstration tests are compared to the quality control specifications of the method to determine if the performance is acceptable.

Capability demonstrations are conducted initially for every analyst on each method performed and annually on a method specific basis thereafter. Acceptable demonstrations are documented for individual training files and retained by the QA staff. New analytes, which are added to the list of analytes for an accredited method, are evaluated for applicability through a demonstration of capability similar to those performed for accredited analytes.

8.6 ***Method Detection Limit Determination***. Annual method detection limit (MDL) studies are performed as appropriate for routine methods used in the laboratory. MDL studies are also performed when there is a change to the method that affects how the method is performed or when an instrumentation change that impacts sensitivity occurs. The procedure used for determining MDLs is described in 40 CFR, Part 136, and Appendix B. Studies are performed for each method on water, soil and air matrices for every instrument that is used to perform the method. MDLs are established at the instrument level. The highest MDL of the pooled instrument data is used to establish a laboratory MDL. MDLs are experimentally verified through the analysis of spiked quality control samples at 1-4 times the concentration of the experimental MDL. The verification is performed on every instrument used to perform the analysis. The quality assurance staff manages the annual MDL determination process and is responsible for retaining MDL data on file. Approved MDLs are appended to the LIMS and used for data reporting purposes.

8.7 ***Limit of Detection (LOD).*** For the DoD ELAP the limit of detection (LOD) for each method and target analyte of concern is established for each instrument that is used to perform the method. The LOD is established by initially spiking a water and/or soil matrix at approximately two to three times the calculated MDL (for a single-analyte standard) or two to four times the calculated MDL (for a multi-analyte standard). The LOD undergoes all sample processing steps and is validated by the qualitative identification of the analytes of interest. The spike concentration establishes the LOD and must be verified quarterly. If the spike concentration in the LOD cannot be verified at the initial level with appropriate analytical quality control, a higher LOD must be defined and verified.

8.8 ***Instrument Detection Limit Determination***. Instrument detection limits (IDLs) are determined for all inductively coupled argon plasma emission spectrophotometers and mass spectrometers. The IDL is determined for the wavelength (emission) of each element and the ion (mass spectrometry) of each element used for sample analysis. The IDL data is used to estimate instrument sensitivity in the absence of the sample matrix. IDL determinations are conducted at the frequency specified in the appropriate SOPs' for ICP and ICP/MS analysis.

8.9 ***Method Reporting Limit.*** The method reporting limit for organic methods is determined by the concentration of the lowest calibration standard in the calibration curve. This value is adjusted based on several sample preparation factors including sample volume, moisture content (soils), digestion, distillation or dilution. The low calibration standard is selected by department managers as the lowest concentration standard that can be used for calibration while continuing to meet the calibration linearity criteria of the method being used. The validity of the method reporting limits are confirmed through the analysis of a spiked quality control sample at the method reporting limit concentration. By definition, detected analytes at concentrations below the low calibration standard cannot be accurately quantitated and are qualified as estimated values.

The reporting limit for inorganics methods is defined as the concentration which is greater than the MDL where method quality control criteria has been achieved. The reporting limit for general chemistry methods employing multiple point calibrations must be greater than or equal to the concentration of the lowest standard of the calibration range.

The reporting limit established for both organic and inorganic analysis is above the calculated method detection limit where applicable.

8.10 ***Limit of Quantitation (LOQ).*** For the DoD ELAP the limit of quantitation (LOQ) for each analyte of concern is determined. The LOQ is set within the range of calibration is greater than the established LOD. Precision and bias criteria for the LOQ are established to meet client requirements and are verified quarterly.

8.11 ***Reporting of Quantitative Data.*** Analytical data for all methods is reported without qualification to the reporting limit established for each method. Data, for organic methods may be reported to the established method detection limit depending upon the client's requirements provided that all qualitative identification criteria for the detected parameter have been satisfied. All parameters reported at concentrations between the reporting limit and the method detection limit are qualified as estimated.

Data for inorganic methods are reported to the established method reporting limits. Inorganic data for specific methods may also be reported to the established method detection limit at client request. However, this data is always qualified as estimated.

Measured concentrations of detected analytes that exceed the upper limit of the calibration range are either diluted into the range and reanalyzed or qualified as an estimated value. The only exception to this applies to ICP and ICP/MS analysis, which can be reported to the upper limit of the experimentally determined linear range without qualification.

8.12 ***Precision and Accuracy Studies***. Annual precision and accuracy (P&A) studies, which demonstrate the laboratories ability to generate acceptable data, are performed for all routine methods used in the laboratory. The procedure used for generating organic P&A data is referenced in the majority of the regulatory methodology in use. The procedure requires quadruplicate analysis of a sample spiked with target analytes at a concentration in the working range of the method. This data may be compiled from a series of existing blank spikes or laboratory control samples. Accuracy (percent recovery) of the replicate analysis is averaged and compared to established method performance limits. Values within method limits indicate an acceptable performance demonstration. Precision and accuracy date is also used to annually demonstrate analytical capability for individual analysts. Annual demonstration of capability data is archived in individual training files.

Performance Limits. The Quality Assurance Director is responsible for compilation and maintenance of all precision and accuracy data used for performance limits. Quality control data for all test methods are accumulated and stored in the laboratory information management system (LIMS). Parameter specific QC data are extracted semi-annually for methods 8260, 8270, 8081, 8082 and annually for remaining methods. Each method is statistically processed to develop laboratory specific warning limits and control limits. The new limits are reviewed and approved by the supervisory staff prior to their use for data assessment. The new limits are used to evaluate QC data for compliance with method requirements for a period of one year. Laboratory generated limits appear on all data reports.

8.13 ***Method Sources & References.*** The Quality Assurance Staff maintains a list of active methods used for the analysis of samples. This list includes valid method references from sources such as USEPA, ASTM or Standard Methods designations and the current version and version date.

Updated versions of approved reference methodology are placed into use as changes occur. The Quality Assurance Director informs operations management of changes in method versions as they occur. The operations management staff selects an implementation date. The operations staff is responsible for completing all method use requirements prior to the implementation date. This includes modification of SOPs, completion of MDL and precision and accuracy studies and staff training. Documentation of these activities is provided to the QA staff who retains this information on file. The updated method is placed into service on the implementation date and the old version is de-activated.

Multiple versions of selected methods may remain in use to satisfy client specific needs. In these situations, the default method version becomes the most recent version. Client specific needs are communicated to the laboratory staff using method specific analytical method codes, which clearly depict the version to be used. The old method version is maintained as an active method until the specified client no longer requires the use of the older version.

SGS Accutest Inc. will not use methodology that represents significant departures from the reference method unless specifically directed by the client. If clients direct the laboratory to use a method modification that represents a significant departure from the reference method, the request will be documented in the project file.

8.14 ***Analytical Capabilities***. Appendix III provides a detailed listing of the methodology employed for the analysis of test samples.

9.0 SAMPLING, SAMPLE MANAGEMENT, LOGIN, CUSTODY, STORAGE AND DISPOSAL

Requirement: The laboratory must employ a system which ensures that client supplied product or supplied product (the sample) is adequately evaluated, acknowledged, and secured upon delivery to the laboratory. The system also assures that product chain of custody is maintained and that sample receipt conditions and preservation status are documented and communicated to the client and internal staff. The login procedure assigns, documents, and maps the specifications for the analysis of each unique sample to assure that the requested analysis is performed on the correct sample and enables the sample to be tracked throughout the laboratory analytical cycle. The system includes procedures for reconciling defects in sample condition or client provided data, which are identified at sample arrival. The system specifies the procedures for proper sample storage, transfer to the laboratory, and disposal after analysis. The system is also documented in standard operating procedures.

9.1 ***Order Receipt and Entry***. New orders are initiated and processed by the client services group (See Chapter 14, Procedures for Executing Client Specifications). The new order procedure includes mechanisms for providing bottles to clients, which meet the size, cleanliness, and preservation specifications for the analysis to be performed.

For new orders, the project manager prepares a bottle request form, which is submitted to sample management. This form provides critical project details to the sample management staff, which are used to prepare and assemble the sample bottles for shipment to the client prior to sampling.

The bottle order is assembled using bottles that meet USEPA specifications for contaminant free sample containers. SGS Accutest Inc. uses a combination of commercially supplied pre-cleaned bottles and bottles that have been tested for residual contamination and verified to meet USEPA specifications prior to use. Sterile bottles for microbiological samples are purchased from commercial sources.

Bottles, which are not purchased pre-cleaned, are checked to assure that they are free of contamination from targeted analytes before being released for use. Sterile bottles are checked for contamination with each lot. The QA staff retains a copy of the documentation of in-house contamination and sterility checks and maintains the responsibility for approving and releasing bottle lots for use following a review of the check data.

Preservative solutions that are specified for the analysis requested are dispensed into the sample bottle prior to shipment. All preservative solutions are prepared in the laboratory or purchased from commercial suppliers. Each solution is checked to assure that it is free of contamination from the compounds being analyzed before being released for use.

Reagent water for trip and field blanks is poured into appropriately labeled containers. All bottles are packed into ice chests with blank chain of custody forms and the original bottle order form. Completed bottle orders are delivered to clients using SGS Accutest Inc. couriers or commercial carriers for use in field sample collection.

9.2 ***Sampling***. Documented procedures are employed by the field staff for field sample collection and are accessible during sample collection activities. Field activities are documented in controlled notebooks which detail relevant field conditions, site data and the results of field measurements. Appropriate custody procedures for collected samples are initiated by the field staff at the time of sample collection. Samples are documented, labeled and preserved according to the specifications of the method and/or regulatory program prior to being shipped to the laboratory.

9.3 ***Sample Receipt and Custody***. Samples are delivered to the laboratory using a variety of mechanisms including SGS Accutest Inc. couriers, commercial shippers, and client self-delivery. Documented procedures are followed for arriving samples to assure that custody and integrity are maintained and handling/ preservation requirements are documented and maintained.

Sample custody documentation is initiated when the individual collecting the sample collects field samples. Custody documentation includes all information necessary to provide an unambiguous record of sample collection, sample identification, and sample collection chronology. Initial custody documentation employs either SGS Accutest Inc. or client generated custody forms.

SGS Accutest Inc. generates a chain of custody in situations where the individuals who collected the sample did not generate custody documentation in the field.

SGS Accutest Inc. defines sample custody as follows:

∴ The sample is in the actual custody or possession of the assigned responsible person,

∴ The sample is in a secure area.

The SGS Accutest Inc. facility is defined as a secure facility. Perimeter security has been established, which limits access to authorized individuals only. Visitors enter the facility through the building lobby and must register with the receptionist prior to entering controlled areas. While in the facility, visitors are required to wear a visitor's badge and must be accompanied by their hosts at all times. After hours, building access is controlled using a computerized passkey reader system. This system limits building access to individuals with a pre-assigned authorization status. After hours visitors are not authorized to be in the building. Clients delivering samples after hours must make advanced arrangements through client services and sample management to assure that staff is available to take delivery and maintain custody.

Upon arrival at SGS Accutest Inc., the sample custodian reviews the chain of custody for the samples received to verify that the information on the form corresponds with the samples

delivered. This includes verification that all listed samples are present and properly labeled, checks to verify that samples were transported and received at the required temperature, verification that the sample was received in proper containers, verification that sufficient volume is available to conduct the requested analysis, and a check of individual sample containers to verify test specific preservation requirements including the absence of headspace for volatile compound analysis.
Sample conditions and other observations are documented on the chain of custody by the sample custodian prior to completing acceptance of custody and in an online database that creates a permanent record of all sample login activities. The sample custodian accepts sample custody upon verification that the custody document is correct. Discrepancies or non-compliant situations are documented and communicated to the SGS Accutest Inc. project manager, who contacts the client for resolution. The resolution is documented and communicated to sample management for execution.

The sample management staff maintains an electronic sample receipt log. This log details all sample-related information in a searchable database that is updated upon data entry and backed up daily. The log records include critical date information, numbers of samples, numbers of bottles for each parameter, descriptions of bottles for each parameter, preservation conditions, bottle refrigerator location, and bottle conditions. Data entry into the log is secured using individual passwords.

During initial login, each bottle is assigned a unique number and is labeled with a barcode corresponding to that number. A bar-coding and scanning system electronically tracks sample custody transfers between individuals within the laboratory. Internal custody documentation may be required for compliance with regulatory agency or contractual specifications. A documented, chronological record of each sample transfer identifying each individual having possession of the sample is created in the laboratory information management system, which can be printed and included in data reports to demonstrate continuous custody.

9.4 ***Laboratory Preservation of Improperly Preserved Field Samples.*** SGS Accutest Inc. will attempt to preserve field samples that were received without proper preservation to the extent that it is feasible and supported by the methods in use. Laboratory preservation of improperly preserved or handled field samples is routinely performed for metals samples. Special handling procedures may also be applied to improperly preserved volatile organics.

Aqueous metals samples that were not nitric acid preserved to pH 2 in the field are laboratory preserved and held for twenty (24) hours to equilibrate prior to analysis. Aqueous metals samples requiring field filtration may be filtered in the laboratory within seventy-two (72) hours of receipt provided that the sample has not been acid preserved.

Unpreserved volatile organics samples may be analyzed within seven (7) days to minimize degradation of volatile organics if the laboratory is notified in advance of the failure to preserve upon collection. Laboratory preservation of unpreserved aqueous samples is not possible. A pH check of volatile organic samples prior to analysis will compromise the sample by allowing volatile organics to escape during the check. If the laboratory is not notified of the failure to field preserve an aqueous volatile organic sample, the defect will not be identified until sample analysis has been completed and the data is qualified accordingly.

9.5 ***Sample Tracking Via Status Change.*** An automated, electronic LIMS procedure records sample exchange transactions between departments and changes in analytical status. This system tracks all preparation, analytical, and data reporting procedures to which a sample is subjected while in the possession of the laboratory. Each individual receiving samples must acknowledge the change in custody and operational status in the LIMS. This step is required to maintain an accurate electronic record of sample status, dates of analytical activity, and custody throughout the laboratory.

Sample tracking is initiated at login where all chronological information related to sample collection dates and holding times are entered into the LIMS. This information is entered on an individual sample basis.

9.6 ***Sample Acceptance Policy***. Incoming samples must satisfy SGS Accutest Inc.'s sample acceptance criteria before being logged into the system. Sample acceptance is based on the premise that clients have exercised proper protocols for sample collection. This includes complete documentation, sufficient volume, proper chemical preservation, temperature preservation, sample container sealing and labeling, and appropriate shipping container packing.

The sample management staff will make every attempt to preserve improperly preserved samples upon arrival. However, if preservation is not possible, the samples may be refused unless the client authorizes analysis. No samples will be accepted if holding times have been exceeded or will be exceeded before analysis can take place unless the client authorizes analysis.

Sample acceptance criteria include proper custody and sample labeling documentation. Proper custody documentation includes an entry for all physical samples delivered to the laboratory with an identification code that matches the sample bottle and a date and signature of the individual who collected the sample and delivered them to the laboratory.

SGS Accutest Inc. reserves the right to refuse any sample which in its sole and absolute discretion and judgment is hazardous, toxic and poses or may pose a health, safety or environmental risk during handling or processing. The company will not accept samples for analysis using methodology that is not performed by the laboratory or for methods that lab does not hold valid accreditations unless arrangements have been made to have the analysis conducted by a qualified subcontractor.

SGS Accutest Inc. does not accept radioactive samples, however, the policy for sample handling of Naturally Occurring Radioactive Materials (NORM) is described below:

Samples that meet the Federal Department of Transportation and International Air Transportation Association criteria could be accepted and handled following normal procedures (except for disposal) in the lab. This corresponds to samples with United Nations

(UN) labels indicating levels of < 500 uR/hour. Samples containing levels at or higher than 500 uR/hour will not be accepted by SGS Accutest Inc. Clients must inform SGS Accutest Inc. of the level of radiation by screening the samples and documenting the level on the Chain of Custody or other form in order for the samples to be accepted.

SGS Accutest Inc. would require that any shipments containing samples of this type must be clearly labeled with UN labels showing the measured level of radioactivity as < 500 uR/hour.

These samples cannot be disposed of in our normal waste streams. Therefore, on completion of analysis, the samples would be returned to the client or disposed of using an alternate waste handler. In either case, the client would be responsible for the additional shipping or disposal charges, as well as processing charges for segregating the waste stream in the lab.

9.7 ***Assignment of Unique Sample Identification Codes***. Unique identification codes are assigned to each sample bottle to assure traceability and unambiguously identify the tests to be performed in the laboratory.

The sample identification coding process begins with the assignment of a unique alphanumeric job number. A job is defined as a group of samples received on the same day, from a specific client pertaining to a specific project. A job may consist of groups of samples received over a multi-day period. The first two characters of the job number are alpha-characters that identify the laboratory facility. The next characters are numeric and sequence by one number with each new job.

Unique sample numbers are assigned to each bottle collected as a discrete entity from a designated sample point. This number begins with the job number and incorporates a second series of numbers beginning at one and continuing chronologically for each point of collection. The test to be performed is clearly identified on the bottle label. Multiple sample bottles collected for analysis of the same parameter are numbered bottle 1, 2, etc.

Alpha suffixes may be added to the sample number to identify special designations such as subcontracted tests, in-house QC checks, or re-logs. Multiple sample bottles for a specific analysis are labeled Bottle 1, Bottle 2, etc.

9.8 ***Subcontracted Analysis***. Subcontract laboratories are employed to perform analysis not performed by SGS Accutest Inc. The quality assurance staff evaluates subcontract laboratories to assure their quality processes meet the standards of the environmental laboratory industry prior to engagement. Throughout the subcontract process, SGS Accutest Inc. follows established procedures to assure that sample custody is maintained and the data produced by the subcontractor meets established quality criteria.

*Subcontracting Procedure***.** Subcontracting procedures are initiated through several mechanisms, which originate with sample management. Samples for analysis by a subcontractor are logged into the SGS Accutest Inc. system using regular login procedures. If subcontract parameters are part of the project or sample management has received subcontracting instructions for a specific project, a copy of the chain of custody is given to the appropriate project manager with the subcontracted parameters highlighted. This procedure triggers the subcontract process at the project management level. The project manager contacts an approved subcontractor that carries accreditation in the venue of the project location to place the subcontract order. A subcontract order form (SOF) is simultaneously prepared in electronic format, by the project manager and filed with the original chain of custody. The SOF and the subcontract chain of custody are forwarded to sample management, via E-Mail, for processing. A copy is filed with the original CoC.

Sample management signs the subcontract chain of custody and ships the sample(s) to the subcontractor. The subcontract CoC is filed with the original CoC and the request for subcontract. Copies are distributed to the login department, the project manager, sample management and the client.

Clients are verbally notified of the need to subcontract analysis as soon as the need is identified by the client services staff. This may occur during the initial project setup or at the time of login if the project setup had not been initiated through the client services staff. Copies of the subcontract CoC and the original CoC, which are electronically distributed to clients, constitutes documented client notification of the laboratories intent to subcontract analysis.

Subcontractor data packages are reviewed by the QA Staff to assess completeness and quality compliance. If completeness defects are detected, the subcontractor is asked to immediately upgrade the data package. If data quality defects are detected, the QA staff retains the package for further review. The QA staff will pursue a corrective action solution before releasing defective data to the client.

Approved subcontract data is entered into the laboratory information management system (LIMS) if possible and incorporated into the final report. All subcontract data is footnoted to provide the client with a clear indication of its source. Copies of original subcontract data are included in the data report depending on the reporting level specified by the client. Applicable subcontractor accreditation information is provided with the subcontractor data.

*Subcontract Laboratory Evaluation***.** The QA staff evaluates subcontract laboratories prior to engagement. The subcontract laboratory must provide SGS Accutest Inc. with proof of a valid certification to perform the requested analysis for the venue where they were collected and for a specific program should an approval or accreditation be required. In addition, the QA staff may require a copy of the laboratory's Quality Systems Manual, copies of SOPs used for the subcontracted analysis, a copy of the most recent performance evaluation study for the subcontracted parameter, copies of the internal data integrity policy and copies of the most recent regulatory agency or third party accreditor audit report. Certification verification must be submitted to SGS Accutest Inc. annually. If possible, the QA staff may conduct a site visit to the laboratory to inspect the quality system. SGS Accutest Inc. assumes the responsibility for the performance of all subcontractors who have successfully demonstrated their qualifications and should obtain an example data deliverable package prior to initiation of subcontract work for compliance review. Qualification of a subcontract laboratory may be bypassed if the primary client directs SGS Accutest Inc. to employ a specific subcontractor.

9.9 ***Sample Storage***. Following sample transfer to the sample custodian, samples are assigned to various secured, refrigerated storage areas depending upon the test to be performed and the matrix of the samples. The location (refrigerator and shelf) of each sample is recorded on the chain of custody adjacent to the line corresponding to each sample number and also entered into the LIMS. Samples remain in storage until the laboratory technician requests that they be transferred into the laboratory for analysis.

Second shift staff is authorized to retrieve samples from storage and initiate custody transfer. All sample request forms must be completed regardless of who performs the transfer.

Samples for volatile organics analysis are placed in storage in designated refrigerators by the sample custodian and immediately transferred to the organics group control. Sample custody is transferred to the department designee. These samples are segregated according to matrix to limit opportunities for cross contamination to occur.

Organics staff is authorized to retrieve samples from these storage areas for analysis. When analysis is complete, the samples are placed back into storage.

9.10 ***Sample Login***. Following sample custody transfer to the laboratory, the documentation that describes the clients analytical requirements are delivered to the sample login group for coding and entry to the Laboratory Information Management System (LIMS). This process translates all information related to collection time, turnaround time, sample analysis, and deliverables into a code which enables client requirements to be electronically distributed to the various departments within the laboratory for scheduling and execution.

The technical staff is alerted to client or project specific requirements through the use of a unique project code that is electronically attached to the job during login. The unique project code directs the technical staff to controlled specifications documents detailing the unique requirements.

9.11 ***Sample Retrieval for Analysis***. Individual laboratory departments prepare and submit written requests to the sample custodian to retrieve samples for analysis. The sample custodian retrieves all samples except volatile organics and delivers them to the requesting department. Retrieval priorities are established by the requesting department and submitted to the sample custodian when multiple requests are submitted. Internal custody transfers using the bar code scanning system occur whenever the samples change hands or locations.
After sample analysis has been completed, the department requests pick-up and return of the sample to the storage area. The sample custodian retrieves the sample and completes the custody transfer from the department of the transfer back to sample management or sample storage.

9.12 ***Sample Disposal***. SGS Accutest Inc. retains all samples and sample extracts under proper storage for a minimum of 30 days following completion of the analysis report. Longer storage periods are accommodated on a client specific basis if required. Samples may also be returned to the client for disposal.
SGS Accutest Inc. disposes of all laboratory wastes following the requirements of the Resource Conservation and Recovery Act (RCRA). The Company has obtained and maintains a waste generator identification number, NJD982533622.

Sample management generates a sample disposal dump sheet from the LIMS tracking system each week, which lists all samples whose holding period has expired. Data from each sample is compared to the hazardous waste criteria established by the New Jersey Department of Environmental Protection (NJDEP).

Samples containing constituents at concentrations above the criteria are labeled as hazardous and segregated into five general waste categories for disposal as follows:

- Waste Oil
- Soil (solids – positive and negative hazardous characteristics)
- Mixed Aqueous
- Sludges (semi-solids)
- PCB Hazardous Waste (USEPA 40 CFR 761 criteria).

Non-hazardous aqueous samples are diluted and disposed directly into the laboratory sink. All aqueous liquids pass through a neutralization system before entering the municipal system. Solid samples are emptied into consolidation drums and disposed as hazardous waste or non-hazardous wastes depending upon the results of hazardous characteristics determination. Samples classified as PCB hazardous wastes are labeled and packaged according to the requirements in 40 CFR 761.

Empty glass and plastic bottles from aqueous and solid samples are segregated for recycling. Recycled materials are collected by a commercial contractor and transferred to a county transfer facility for separation into various materials categories. These operations are classified as secure facilities employing cameras, security guards and fiber optic security systems.
The recyclable material is transported to a recycling facility for further processing. Separated glass is transported to a processing facility where it is acid washed in two, separate wash baths, rinsed in boiling water and ground into ½ inch chunks. The chunks are transported to an end product user for re-manufacturing into a glass product.

Separated plastic is transported to a processing facility where it is acid washed to remove the labels and adhesives and boiled for sterilization. The sample containers and any remaining labels are shredded and ground resulting in complete destruction of remaining labels the ground material is sent by rail car or tractor-trailer to various end users that melt and reform the material into useful products of their industry. The recycling facility employs a Code of Ethics in which all client names are confidential and are not divulged to any individual or corporation without written permission from the client.

Laboratory wastes are collected by waste stream in designated areas throughout the laboratory. Waste streams are consolidated twice each week by the waste custodian and transferred to stream specific drums for disposal through a permitted waste management contractor. Filled, consolidated drums are tested for hazardous characteristics and scheduled for removal from the facility for appropriate disposal based on the laboratory data.

All solvent extracts and digestates are collected for disposal following the thirty-day holding period and drummed according to their specific waste stream category. Chlorinated solvent extracts are drummed as chlorinated wastes (i.e., Methylene Chloride). Non-chlorinated solvent extracts are drummed as non-chlorinated wastes (i.e., acetone, hexane, methanol, and mixed solvents). Digestates are collected for disposal following the thirty-day holding period and drummed as corrosive liquid containing metals.

10.0 LABORATORY INSTRUMENTATION AND MEASUREMENT STANDARDS

Requirement: The laboratory has established procedures, which assure that instrumentation is performing to a pre-determined operational standard prior to the analysis of any samples. In general, these procedures follow the regulatory agency requirements established in promulgated methodology. The instrumentation selected to perform specified analysis are uniquely identified and capable of providing the method specified uncertainty of measurement needed. These procedures are documented and incorporated into the standard operating procedures for the method being executed.

10.1 ***Mass Tuning – Mass Spectrometers***. The mass spectrometer tune and sensitivity is monitored to assure that the instrument is assigning masses and mass abundances correctly and that the instrument has sufficient sensitivity to detect compounds at low concentrations. This is accomplished by analyzing a specific mass tuning compound at a fixed concentration. If the sensitivity is insufficient to detect the tuning compound, corrective action must be performed prior to the analysis of standards or samples. If the mass assignments or mass abundances do not meet criteria, corrective action must be performed prior to the analysis of standards or samples.

10.2 ***Wavelength Verification – Spectrophotometers***. Spectrophotometer detectors are checked on a regular schedule to verify proper response to the wavelength of light needed for the test in use. If the detector response does not meet specifications, corrective action (detector adjustment or replacement) is performed prior to the analysis of standards or samples.

10.3 ***Inter-element Interference Checks (Metals)***. Inductively Coupled Plasma Emission Spectrophotometers (ICP) are subject to a variety of spectral interferences, which can be minimized or eliminated by applying interfering element correction factors and background correction points. Interfering element correction factors are checked on a specified frequency through the analysis of check samples containing high levels of interfering elements. Analysis of single element interferant solutions is also conducted at a specified frequency.

If the check indicates that the method criteria have not been achieved for any element in the check standard, the analysis is halted and data from the affected samples are not reported. Sample analysis is resumed after corrective action has been performed and the correction factors have been re-calculated.

New interfering element correction factors are calculated and applied whenever the checks indicate that the correction factors are no longer meeting criteria. At a minimum, correction factors are replaced once a year.

Inductively Coupled Plasma – Mass Spectrometry (ICP-MS) also is subject to isobaric elemental and polyatomic ion interferences. These interferences are corrected through the use of calculations. The accuracy of corrections is dependent on the sample matrix and instrument conditions and is verified by quality control checks on individual runs.

10.4 ***Calibration and Calibration Verification***. Many tests require calibration using a series of reference standards to establish the concentration range for performing quantitative analysis. Instrument calibration is performed using standards that are traceable to national standards. Method specific procedures for calibration are followed prior to any sample analysis. In general, if a reference method does not specify the number of calibration standards, the minimum number is two (one of which is at the reporting limit or limit of quantitation).

Calibration is performed using a linear regression calculation or calibration factors calculated from the curve. The calibration must meet method specific criteria for linearity or precision. If the criteria are not achieved, corrective action (re-calibration or instrument maintenance) is performed. The instrument must be successfully calibrated before analysis of samples can be conducted.

Initial calibration for metals analysis performed using inductively coupled plasma (ICP) employs the use of a single standard and a calibration blank to establish linearity. Inductively Coupled Plasma – Mass Spectrometry (ICP-MS) can be calibrated using either a two point or a multi-point calibration, as long as all quality control criteria for the analysis can be achieved. The calibration blank contains all reagents that are placed into the calibration standard with the exception of the target elements. Valid calibration blanks must not contain any target elements.

Initial calibrations must be verified using a single concentration calibration standard from a second source (i.e. separate lot or different provider). The continuing validity of existing calibrations must be regularly verified using a single calibration standard. The response to the standard must meet pre-established criteria that indicate the initial calibration curve remains valid. If the criteria are not achieved corrective action (re-calibration) is performed before any additional samples may be analyzed.

If continuing calibration verification results are outside established criteria, data associated with the verification may be fully useable under the following conditions:

- When the acceptance criteria for the continuing calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported.

- When the acceptance criteria for the continuing calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level.

Calibration verification is also performed whenever it appears that the analytical system is out of calibration or no longer meets the calibration requirements. It is also performed when the time period between calibration verifications has expired.

Sample results are quantitated from the initial instrument calibration unless otherwise required by regulation, method, or program specific criteria.

10.5 ***Linear Range Verification and Calibration (ICP & ICP/MS Metals)***. Linear range verification is performed for all ICP and ICP/MS instrumentation. The regulatory program or analytical method specifies the verification frequency. A series of calibration standards are analyzed over a broad concentration range. The data from these analyses are used to determine the valid analytical range for the instrument. ICP instrument calibration is routinely performed using a single standard at a concentration within the linear range and a blank.

Some methods or analytical programs require a low concentration calibration check to verify that instrument sensitivity is sufficient to detect target elements at the reporting limit. The analytical method or regulatory program defines the criteria used to evaluate the low concentration calibration check. If the low calibration check fails criteria, corrective action is performed and verified through reanalysis of the low concentration calibration check before continuing with the field sample analysis. . ICP-MS instrument calibration is normally performed using multiple standards within the linear range and a blank, but may be done with a single standard at a concentration within the linear range and a blank.

10.6 ***Retention Time Development and Verification (GC)***. Chromatographic retention time windows are developed for all analysis performed using gas chromatographs with conventional detectors. An initial experimental study is performed, which establishes the width of the retention window for each compound. The retention time width of the window defines the time ranges for elution of specified target analytes on the primary and confirmation columns. Retention time windows are established upon initial calibration, applying the retention time range from the initial study to each target compound. Retention times are regularly confirmed through the analysis of an authentic standard during calibration verification. If the target analytes do not elute within the defined range during calibration verification, the instrument must be recalibrated and new windows defined. New studies are performed when major changes, such as column replacement are made to the chromatographic system.

10.7 ***Equipment List.*** See Appendix IV for a listing of all equipment used for measurement and/or calibration in laboratory processes.

11.0 INSTRUMENT MAINTENANCE

Requirement. Documented procedures have been established for conducting equipment maintenance. The procedure includes maintenance schedules if required or documentation of daily maintenance activities. All instrument maintenance activities are documented in instrument specific logbooks.

11.1 ***Routine, Daily Maintenance***. Routine, daily maintenance is required on an instrument specific basis and is performed each time the instrument is used. Daily maintenance includes activities to insure a continuation of good analytical performance. This may include performance checks that indicate if non-routine maintenance is needed. If performance checks indicate the need for higher level maintenance, the equipment is taken out of service until maintenance is performed. Analysis cannot be continued until all performance checks meet established criteria and a return to operational control has been demonstrated and documented. The individual assigned to the instrument is responsible for daily maintenance.

11.2 ***Non-routine Maintenance***. Non-routine maintenance is initiated for catastrophic occurrences such as instrument failure. The need for non-routine maintenance is indicated by failures in general operating systems that result in an inability to conduct required performance checks or calibration. Equipment in this category is taken out of service, tagged accordingly and repaired before attempting further analysis. Before initiating repairs, all safety procedures for safe handling of equipment during maintenance, such as lock-out/tag-out are followed. Analysis is not resumed until the instrument meets all operational performance check criteria, is capable of being calibrated and a return to operational control has been demonstrated and documented. Section supervisors are responsible for identifying non-routine maintenance episodes and initiating repair activities to bring the equipment on-line. This may include initiating telephone calls to maintenance contractors if necessary. They are responsible for documenting all details related to the occurrence and repair.

11.3 ***Scheduled Maintenance***. Modern laboratory instrumentation rarely requires regular preventative maintenance. If required, the equipment is placed on a schedule, which dictates when maintenance is needed. Examples include annual balance calibration by an independent provider or ICP preventative maintenance performed by the instrument manufacturer. Section supervisors are responsible for initiating scheduled maintenance on equipment in this category. Scheduled maintenance is documented using routine documentation practices.

11.4 ***Maintenance Documentation***. Routine and non-routine maintenance activities are documented in logbooks assigned to instruments and equipment used for analytical measurements. The logbooks contain preprinted forms, which specify the required maintenance activities. The analyst or supervisor performing or initiating the maintenance activity is required to check the activity upon its completion and initial the form. This includes documenting that the instrument has been returned to operational control following the completion of the activity. Non-routine maintenance (repairs, upgrades) is documented on the back page of the service log.

12.0 QUALITY CONTROL PARAMETERS, PROCEDURES, AND CORRECTIVE ACTION

Requirement: All procedures used for test methods incorporate quality control parameters to monitor elements that are critical to method performance. Each quality parameter includes acceptance criteria that have been established by regulatory agencies for the methods in use. Criteria may also be established through client dictates or through the accumulation and statistical evaluation of internal performance data. Data obtained for these parameters during routine analysis must be evaluated by the analyst, and compared to the method criteria in use. If the criteria are not achieved, the procedures must specify corrective action and conformation of control before proceeding with sample analysis. QC parameters, procedures, and corrective action must be documented within the standard operating procedures for each method. In the absence of client specific objectives the laboratory must define qualitative objectives for completeness and representativeness of data.

12.1 ***Procedure***. Bench analysts are responsible for methodological quality control and sample specific quality control. Each method specifies the control parameters to be employed for the method in use and the specific procedures for incorporating them into the analysis. These control parameters are analyzed and evaluated with every designated sample group (batch).

The data from each parameter provides the analyst with critical decision making information on method performance. The information is used to determine if corrective action is needed to bring the method or the analysis of a specific sample into compliance. These evaluations are conducted throughout the course of the analysis. Each control parameter is indicative of a critical control feature. Failure of a methodological control parameter is indicative of either instrument or batch failure. Failure of a sample control parameter is indicative of control difficulties with a specific sample or samples.

Sample Batch. All samples analyzed in the laboratory are assigned to a designated sample batch, which contains all required quality control samples and a defined maximum number of field samples that are prepared and/or analyzed over a defined time period. The maximum number of field samples in the batch is 20. SGS Accutest Inc. has incorporated the TNI Standard batching policy as the sample-batching standard. This policy incorporates the requirement for blanks and spiked blanks as a time based function as defined by TNI Standard. Accordingly, the specified time period for a sample batch is 24 hours. Matrix spike/matrix spike duplicate, matrix spikes and duplicates are defined as sample frequency based functions and may be applied to several batches until the frequency requirement has been reached. A matrix spike/matrix spike duplicate, matrix spikes and/or duplicate is required every 20 samples.

Client criteria that defines a batch as a time based function which includes a matrix spike/matrix spike duplicates as a contractual specification will be honored. The typical batch contains a blank and a laboratory control sample (LCS or spiked blank). Batch documentation includes lot specifications for all reagents and standards used during preparation of the batch.

12.2 ***Methodological Control Parameters and Corrective Action***. Prior to the analysis of field samples the analyst must determine that the method is functioning properly. Specific control parameters indicate whether critical processes meet specified requirements before continuing with the analysis. Method specific control parameters must meet criteria before sample analysis can be conducted. Each of these parameters is related to processes that are under the control of the laboratory and can be adjusted if out of control.

Method Blank. A method blank is analyzed during the analysis of any field sample. The method blank is defined as a sample. It contains the same standards (internal standards, surrogates, matrix modifiers, etc.) and reagents that are added to the field sample during analysis, with the exception of the sample itself. If the method blank contains target analytes(s) at concentrations that exceed method detection limit concentrations (organics) or reporting limit concentrations (inorganics), the source of contamination is investigated and eliminated before proceeding with sample analysis. Target analyte(s) in method blanks at concentrations no greater than one-half of the reporting limit concentrations (metals) may be requested on a client or project specific basis. Systematic contamination is documented for corrective action and resolved following the established corrective action procedures.

Laboratory Control Samples (LCS or Spiked Blanks). A laboratory control sample (spiked blank or commercially prepared performance evaluation sample) is analyzed along with field samples to demonstrate that method accuracy is within acceptable limits. These spike solutions may be from different sources than the sources of the solutions used for method calibration depending upon the method requirements. All target components are included in the spike mixture over a two year period. The performance limits are derived from published method specifications or from statistical data generated from the analysis of laboratory method performance samples. Spiked blanks are blank matrices (reagent water or clean sand) spiked with target parameters and analyzed using the same methods used for samples. Accuracy data is compared to laboratory derived limits to determine if the method is in control. Laboratory control samples (LCS) are commercially prepared spiked samples in an inert matrix. Performance criteria for recovery of spiked analytes are pre-established by the commercial entity preparing the sample. The sample is analyzed in the laboratory as an external reference.

Accuracy data is compared to the applicable performance limits. If the spike accuracy exceeds the performance limits, corrective action, as specified in the SOP for the method is performed and verified before continuing with a field sample analysis. In some cases, decisions are made to continue with sample analysis if performance limits are exceeded, provided the unacceptable result has no negative impact on the sample data.

Blanks and spikes are routinely evaluated before samples are analyzed. However, in situations where sample analysis is performed using an auto sampler, they may be evaluated after sample analysis has occurred. If the blanks and spikes do not meet criteria, sample analysis is repeated.

Proficiency Testing. Proficiency test samples (PTs) are single or double blind spikes, introduced to the laboratory to assess method performance. PTs may be introduced as double blinds submitted by commercial clients, single or double blinds from regulatory agencies, or internal blinds submitted by the QA group.

A minimum of two single blind studies must be performed each year for every parameter in aqueous and solid matrices for each field of testing for which the laboratory maintains accreditation. Proficiency samples must be purchased as blinds from an A2LA accredited vendor. Data from these studies are provided to the laboratory by the vendor and reported to accrediting agencies. If unsatisfactory performance is noted, corrective action is performed to identify and eliminate any sources of error. A new single blind must be analyzed if required to demonstrate continuing proficiency.

PT samples performed for accrediting agencies or clients, which do not meet performance specifications, require a written summary that documents the corrective action investigation, findings, and corrective action implementation. A copy of this summary shall be submitted to the TNI Standard Primary Accrediting Authority, NJDEP Office of Quality Assurance for review.

Single or double blind proficiency test samples may be employed for self-evaluation purposes. Data from these analyses are compared to established performance limits. If the data does not meet performance specifications, the system is evaluated for sources of acute or systematic error. If required, corrective action is performed and verified before initiating or continuing sample analysis.

Trend Analysis for Control Parameters. The quality assurance staff is responsible for continuous analytical improvement through quality control data trend analysis. Accuracy data for spiked parameters in the spiked blank are statistically evaluated weekly for trends indicative of systematic problems. Data from LCS parameters and surrogates are pooled on a method, matrix, and instrument basis. This data is evaluated by comparison to existing control and warning limits. Trend analysis is performed automatically as follows:

- Any point outside the control limit
- Any three consecutive points between the warning and control limits
- Any eight consecutive points on the same side of the mean.
- Any six consecutive points increasing or decreasing

The results of the trend analysis are transmitted as .PDF files for supervisory evaluation prior to sample analysis. Trends that indicate the potential loss of statistical control are further evaluated to determine the impact on data quality and to determine if corrective action is necessary. If corrective action is indicated, the supervisor informs the analysts of the corrective actions to be performed. Return to control is demonstrated before analysis resumes.

12.3 ***Sample Control Parameters and Corrective Action***. The analysis of samples can be initiated following a successful demonstration that the method is operating within established controls. Additional controls are incorporated into the analysis of each sample to determine if the method is functioning within established specifications for each individual sample. Sample

QC data is evaluated and compared to established performance criteria. If the criteria are not achieved the method or the SOP specifies the corrective action required to continue sample analysis. In many cases, failure to meet QC criteria is a function of sample matrix and cannot be remedied. Each parameter is designed to provide quality feedback on a defined aspect of the sampling and analysis episode.

Duplicates. Duplicate sample analysis is used to measure analytical precision. This can also be equated to laboratory precision for homogenous samples. Precision criteria are method dependent. If precision criteria are not achieved, corrective action or additional action may be required. Recommended action must be completed before sample data can be reported.

Laboratory Spikes & Spiked Duplicates. Spikes and spiked duplicates are used to measure analytical precision and accuracy for the sample matrix selected. Precision and accuracy criteria are method dependent. If precision and accuracy criteria are not achieved, corrective action or additional action may be required. Recommended action must be completed before reporting sample data. All target components are included in the spike mixture over a two year period.

Serial Dilution (Metals). Serial dilutions of metals samples are analyzed to determine if analytical matrix effects may have impacted the reported data. If the value of the serially diluted samples does not agree with the undiluted value within a method-specified range, the sample matrix may be causing interferences, which may lead to either a high or low bias. If the serial dilution criterion is not achieved, it must be flagged to indicate possible bias from matrix effects.

Post Digestion Spikes. Digested samples are spiked and analyzed to determine if matrix interferences are biasing the results when the pre-digestion spike (matrix spike) recovery falls outside the control limits. It may also be used to determine potential interferences per client's specification. The sample is spiked at the concentration specified in the method SOP. No action is necessary if the post digestion spike is outside of the method criteria, unless a preparation problem is suspected with the spike, in which case the post digestion spike should be re-prepared and reanalyzed.

Surrogate Spikes (Organics). Surrogate spikes are organic compounds that are similar in behavior to the target analytes but unlikely to be found in nature. They are added to all quality control and field samples to measure method performance for each individual sample. Surrogate accuracy limits are derived from published method specifications or from the statistical evaluation of laboratory generated surrogate accuracy data. Accuracy data is compared to the applicable performance limits. If the surrogate accuracy exceeds performance limits, corrective action, as specified in the method or SOP is performed before sample data can be reported.

Internal Standards (Organic Methods). Internal standards are retention time and instrument response markers added to every sample to be used as references for quantitation. Their response is compared to reference standards and used to evaluate instrument sensitivity on a sample specific basis. Internal standard retention time is also compared to reference standards to assure that target analytes are capable of being located by their individual relative retention time.

If internal standard response criteria are not achieved, corrective action or additional action may be required. The recommended action must be completed before sample data can be reported.

If the internal standard retention time criteria are not achieved corrective action or additional action may be required. This may include re-calibration and re-analysis. Additional action must be completed before sample data is reported.

Internal Standards (ICP and ICP/MS Metals). Internal standards are used on ICP instruments to compensate for variations in response caused by differences in sample matrices. Multiple internal standards are used for each sample on ICP/MS instruments to compensate for variations in response caused by differences in sample matrices. This adjustment is performed automatically during sample analysis. The internal standard response of replicated sample analysis is monitored to detect potential analytical problems. If analytical problems are suspected, then the field samples may be reanalyzed or reanalyzed upon dilution to minimize the interferences. A different internal standard may be employed for quantitation in situations where the field sample contains the element typically used as the internal standard.

12.4 ***Laboratory Derived Quality Control Criteria.*** Control criteria for in-house methods and client specific modifications that exceed the scope of published methodology are defined and documented prior to the use of the method. The Quality Assurance Director is responsible for identifying additional control criteria needs. Control parameters and criteria, based on best technical judgment are established using input provided by the operations staff. These control parameters and criteria are documented and incorporated into the method.

The laboratory-derived criteria are evaluated for technical soundness on spiked samples prior to the use of the method on field samples. The technical evaluation is documented and archived by the Quality Assurance Staff.

When sufficient data from the laboratory developed control parameter is accumulated, the data is statistically processed and the experimentally derived control limits are incorporated into the method.

12.5 ***Bench Review & Corrective Action***. The bench chemists are responsible for all QC parameters. Before proceeding with sample analysis, they are required to successfully meet all instrumental QC criteria. They have the authority to perform any necessary corrective action before proceeding with sample analysis. Their authority includes the responsibility for assuring that departures from documented policies and procedures do not occur.

The bench chemists are also responsible for all sample QC parameters. If the sample QC criteria are not achieved, they are authorized and required to perform the method specified corrective action before reporting sample data.

12.6 ***Data Qualifiers*.** An alpha character coding system is employed for defining use limitations for reported data. These limitations are applied to analytical data by the analyst to clarify the usefulness of the reported data for data user. Common data qualifiers and their definitions are as follows:

Organics.

J: Indicates an estimated value. Applied to calculated concentrations for tentatively identified compounds and qualitatively identified compounds whose concentration is below the reporting limit, but above the MDL.

N: Indicates qualitative evidence of a tentatively identified compound whose identification is based on a mass spectral library search and is applied to all TIC results.

C: Applied to pesticide data that has been qualitatively confirmed by GC/MS.

B: Used for analytes detected in the sample and its associated method blank.

E: Applied to compounds whose concentration exceeds the upper limit of the calibration range.

Metals and Inorganics.

B: Applied if the reported concentration value was less than the reporting limit but greater than the MDL.

U: Applied if the reading is less than the MDL (or IDL if IDL reporting is being used).

E: Estimated concentration caused by the presence of interferences, normally applied when the serial dilution is out.

N: Spike sample recovery not within control limits.

*: Duplicate or matrix spike duplicate analysis not within control limits.

12.7 ***Data Package Review***. SGS Accutest Inc. employs at least two levels of data review, the final review must be performed by a manager, supervisor or designated reviewer, to assure that reported data has satisfied all quality control criteria and that client specifications and requirements have been met. Each production department has developed specific data review procedures, which must be completed before data is released to the client.

Analytical Review. The analyst conducts the primary review of all data. This review begins with a check of all instrument and method quality control and progresses through sample quality control, concluding with a check to assure that the client's requirements have been executed. Analyst checks focus on a review of qualitative determinations and checks of precision and accuracy data to verify that existing laboratory criteria have been achieved.

Checks at this level may include comparisons with project specific criteria if applicable. The analyst has the authority and responsibility to perform corrective action for any out-of-control parameter or nonconformance at this stage of review.

Analysts who have met the qualification criteria for the method in use perform secondary, peer level data reviews. Analyst qualification requirements include a valid demonstration of capability and demonstrated understanding of the method SOP. Section supervisors may perform secondary review in-lieu of a peer review. Managers, Supervisors or designated reviewers evaluate 100% of the data produced by their department. It includes a check of all manual calculations; an accuracy check of manually transcribed data from bench sheets to the LIMS, a check of calibration and continuing calibration, all QC criteria and a comparison of the data package to client specified requirements. Also included are checks to assure the appropriate methodology was applied and that all anomalous information was properly flagged for communication in the case narrative. Supervisors have the authority to reject data and initiate re-analysis, corrective action, or reprocessing.

All laboratory data requiring manual entry into LIMS system is double-checked by the analysts performing initial data entry and the section supervisor. Verification of supervisory review is indicated on the raw data summary by the manager, supervisor, or designated reviewer's initials and date.

Electronic data that is manually edited at the bench by the primary analyst is automatically flagged by the instrument data system indicating an override by the analyst. All manual overrides must be verified and approved by a supervisor who initials and dates all manual changes.

Hard copies (or PDF's) of manually integrated chromatographic peaks are printed that clearly depict the manually drawn baseline. The hard copy (or PDF) is reviewed and approved by the section manager, supervisor or designated reviewer (initialed and dated) and included in the data package of all full tier reports or the archived batch records of commercial report packages.

Edits to electronic data that have already been committed to the LIMS database are controlled through the use of the Master Edit function in LIMS. Permission to access this program is limited to those approved by the upper levels of laboratory management and is controlled by the Information Technology staff. A GALP electronic audit record trail is maintained for all changes that are made and is automatically appended to the record.

The group manager performs a tertiary review on a spot check basis. This review includes an evaluation of QC data against acceptance criteria and a check of the data package contents to assure that all analytical requirements and specifications were executed.

Report Generation Review. The report generation group reviews all data and supporting information delivered by the laboratory for completeness and compliance with client specifications. Missing deliverables are identified and obtained from the laboratory. The group also reviews the completed package to verify that the delivered product complies with all client specifications. Non-analytical defects are corrected before the package is sent to the client.

Project Management/Quality Control Review. Spot-check data package reviews are performed by the project management staff. Project management reviews focus on project specifications. If the project manager identifies defects in the product prior to release, he initiates immediate corrective action to rectify the situation.

The QA staff performs a post-delivery check of completed data packages to verify completeness and compliance with established quality control procedures. Approximately 10% of Full-Deliverables data packages are reviewed. A formal checklist is used to assess data report completeness and accuracy. Detected deficiencies are documented on the checklist and corrective actions initiated as necessary. Data review checklists are electronic documents, which are archived in the QA Directory of the network server.

The QA review focuses on all elements of the deliverable including the client's specifications and requirements, analytical quality control, sample custody documentation and sample identification. QA reviews at this step in the production process are geared towards systematic process defects, which require procedural changes to effect a corrective action. However, if defects are identified that have an adverse effect on data, the client is immediately informed following standard notification procedures. QA data review is not used in lieu of a peer level review or a supervisory review.

Data Reporting. Analytical data is released to clients following a secondary review by the manager, supervisor or designated reviewer. Data release at this stage of the process is limited to electronic information, which is released to clients through a secure, encrypted, password protected, Internet connection. Hard copy support data is compiled by the report generation group and assembled into the final report. The report is sent to the client following reviews by the report generation staff.

All data reports include specified information, which is required to identify the report and its contents. This information includes a title, name and address of the laboratory, a unique report number, total number of pages in the report, clients name and address, analytical method identification, arriving sample condition, sample and analysis dates, test results with units of measurement, authorized signature of data release, statement of applicability, report reproduction restrictions and TNI Standard requirements certification. Data reports for the Department of Defense ELAP also include the time of preparation and analysis.

12.8 ***<u>Electronic Data Reduction</u>.*** Raw data from sample analysis is entered into the laboratory information management system (LIMS) using automated processes or manual entry. Final data processing is performed by the LIMS using procedures developed by the Company.

All LIMS programs are tested and validated prior to use to assure that they consistently produce correct results. The Information Technology Staff performs software validation testing. The testing procedures are documented in an SOP. Software programs are not approved for use until they have demonstrated that they are capable of performing the required calculations.

12.9 ***Representativeness***. Data representativeness is based on the premise that qualitative and quantitative information developed for field samples is characteristic of the sample that was collected by the client and analyzed in the laboratory. The laboratory objective for representativeness defines data as representative if the criteria for all quality parameters associated with the analysis of the sample are achieved.

12.10 ***Comparability***. Analytical data is defined as comparable when data from a sample set analyzed by the laboratory is representatively equivalent to other sample sets analyzed separately regardless of the analytical logistics. The laboratory will achieve 100% comparability for all sample data which meets the criteria for the quality parameters associated with its analysis using the method requested by the client.

13.0 CORRECTIVE ACTION SYSTEM

Requirement. The laboratory employs policies and procedures for correcting defective processes, systematic errors, and quality defects enabling the staff to systematically improve product quality. The system includes procedures for communicating items requiring corrective action to responsible individuals, corrective action tracking procedures, corrective action documentation, monitoring of effectiveness, and reports to management. The system is fully documented in a standard operating procedure. Individual corrective actions and responses are documented in a dedicated database.

13.1 ***Procedure***. Corrective action is the step that follows the identification of a process defect. The type of defect determines the level of documentation, communication, and training necessary to prevent re-occurrence of the defect or non-conformance. The formal system is maintained by the quality assurance department. Operations management is responsible for working within the system to resolve identified deficiencies.

Routine Corrective Action. Routine corrective action is defined as the procedures used to return out of control analytical systems back to control. This level of corrective action applies to all analytical quality control parameters or analytical system specifications.

Bench analysts have full responsibility and authority for performing routine corrective action. The resolution of defects at this level does not require a procedural change or staff re-training. The analyst is free to continue work once corrective action is complete and the analytical system has been returned to control. Documentation of routine corrective actions is limited to logbook comments for the analysis being performed.

Process Changes. Corrective actions in this category require procedural modifications. They may be the result of systematic defects identified during audits, the investigation of client inquiries, failed proficiency tests, product defects identified during data review, or method updates. Resolution of defects of this magnitude requires formal identification of the defect, development and documentation of a corrective action plan, and staff training to communicate the procedural change.

Technical Corrective Action. Technical corrective action encompasses routine corrective action performed by bench analysts for out of control systems and corrective actions performed for data produced using out of control systems. Technical corrective action for routine situations is conducted using the procedures detailed above.

Non-routine corrective actions apply to situations where the bench analysts failed to perform routine corrective action before continuing analysis. Supervisors and Department Managers perform corrective action in these situations. Documentation of all non-routine corrective actions is performed using the corrective action system.

Sample re-analysis is conducted if sufficient sample and holding time remain to repeat the analysis using an in-control system. If insufficient sample or holding time remains, the data is processed and qualifiers applied that describe the out of control situation. The occurrence is further documented in the case narrative and in the corrective action response. The corrective action must include provisions for retraining the analysts who failed to perform routine corrective action.

13.2 ***Documentation & Communication***. Routine corrective actions are documented as part of the analytical record. Notations are made in the comments section of the analytical chronicle or data sheet detailing the nonconformance and corrective action. Continuation of the analysis indicates that return to control was successful.

Corrective actions for process changes are documented, tracked and monitored for effectiveness. Supervisors or senior staff members may initiate corrective actions by generating a corrective action using the corrective action database application.

The corrective action database is an Access application. The initiator generates the corrective action investigation form, which is documented, tracked, distributed to responsible parties and archived through the application. The application assigns a tracking number, initiation data and due date to each action and copies the corrective action form to the database. E-mail message containing the form is automatically distributed to the responsible parties for resolution.

The responsible party identifies the root cause of the defect, initiates the immediate fix and develops and implements the procedural change. Existing documentation such as SOPs are edited to reflect the change. The affected staff is informed of the procedural change through a formal training session. The training is documented and copies are placed into individual training files. The corrective action form is completed by the responsible party and returned to the QA staff via e-mail using the database application.

Initial and completed corrective action forms are maintained in the corrective action database. This entire database is backed up and archived daily. The corrective action tracking form is maintained as an active report in the database.

Monitoring. The QA Staff monitors the implemented corrective action until it is evident that the action has been effective and the defect has been eliminated. The corrective action database is updated by QA to reflect closure of the corrective action. The QA staff assigns an error code to the corrective action for classification of the type of errors being committed. Additional monitoring of the corrective action is conducted during routine laboratory audits.

Additional monitoring of the corrective action is conducted by adding the corrective action to a verification list by the QA staff at closure. Verification is performed by the QA Staff to assure that the corrective action has remained in effect is scheduled for six (6) months from the initial closure date.

If QA determines that the corrective action response has not effectively remedied the deficiency, the process continues with a re-initiation of the corrective action. Corrective action continues until the defect is eliminated. If another procedural change is required, it is treated as a new corrective action, which is documented and monitored using established procedures.

Client Notification. Defective processes, systematic errors, and quality defects, detected during routine audits may have negative impacts on data quality. In some cases, data that has been released to clients may be affected. If defective data has been released for use, SGS Accutest Inc. will notify the affected clients of the defect and provide specific details regarding the magnitude of the impact to their data.

14.0 PROCEDURES FOR EXECUTING CLIENT SPECIFICATIONS

Requirement. Systems have been established for evaluating and processing client specifications for routine and non-routine analytical services. The systems enable the client services staff to identify, evaluate, and document the requested specifications to determine if adequate resources are available to perform the analysis. The system includes procedures for communicating the specifications to the laboratory staff for execution and procedures for verifying the specifications have been executed.

14.1 ***Client Specific Requirements***. The project manager is the primary contact for clients requesting laboratory services. Client specifications are communicated using several mechanisms. The primary sources of information are the client's quality assurance project plan (QAPjP) and the analytical services contract both of which detail the analytical, quality control and data reporting specifications for the project. In the absence of a QAPjP, projects specifications can also be communicated using contracts, letters of authorization, or letters of agreement, which may be limited to a brief discussion of the analytical requirements and the terms and conditions for the work. These documents may also include pricing information, liabilities and scope of work, in addition to the analytical requirements. QAPjPs include detailed analytical requirements and data quality objectives, which supersede those found in the referenced methods. This information is essential to successful project completion.

The client services staff provides additional assistance to clients who are unsure of the specifications they need to execute the sampling and analysis requirements of their project. They provide additional support to clients who require assistance in results interpretation as needed, provided they possess the expertise required to render an opinion.

The project manager is responsible for obtaining project documents, which specify the analytical requirements. Following project management review, copies are distributed to the QA Director and the appropriate departmental managers for review and comment. The original QAPjP is filed in a secure location.

14.2 ***Requirements for Non-Standard Analytical Specifications***. Client requirements that specify departures from documented policies, procedures, or standard specifications must be submitted to SGS Accutest Inc. in writing. These requirements are reviewed and approved by the technical staff before the project is accepted. Once accepted, the non-standard requirements become analytical specifications, which follow the routine procedure for communicating client specifications. Departures from documented policies, procedures, or standard specifications that do not follow this procedure are not permitted.

14.3 ***Evaluation of Resources.*** A resource evaluation is completed prior to accepting projects submitted by clients. The evaluation is initiated by the client services staff who prepares a brief synopsis that includes the logistical requirements of the project. Logistical specifications for new projects are summarized in writing for evaluation by the affected departments. The specifications are evaluated by the department manager from a scheduling and hardware resources perspective. The project is not accepted unless the department managers have the necessary resources to execute the project according to client specifications.

14.4 ***Documentation***. New projects are initiated using LIMS or a project set up form, which is completed prior to the start of the project. This form details all of the information needed to correctly enter the specifications for each client sample into the laboratory information management system (LIMS). The form includes data reporting requirements, billing information, data turnaround times, QA level, state of origin, and comments for detailing project specific requirements. The project manager is responsible for obtaining this information from the client and completing the form prior to sample arrival and login.

Sample receipt triggers project creation and the login process. The information on the set-up form is entered into the LIMS immediately prior to logging in the first sample. The set up form may be accompanied by a quotation, which details the analytical product codes and sample matrices. These details are also entered into the LIMS during login.

Special information is distributed to the laboratory supervisors and login department in electronic or hardcopy format upon project setup. All, project specific information is retained by the project manager in a secure file. The project manager maintains a personal telephone log, which details conversations with the client regarding the project.

Department managers prepare summary sheets that detail client specific analytical requirements for each test. Bench analysts use these sheets to obtain information regarding client specific analytical requirements before analyzing samples. A program code is established for each client that links the client specifications to a client project. This code is attached to a project by the project manager at login and listed on the work list for each work group conducting analysis for clients with standing requirements.

14.5 ***Communication***. A pre-project meeting is held between client services and the operations managers to discuss the specifications described in the QAPjP, contract and/or related documents. Project logistics are discussed and finalized and procedures are developed to assure proper execution of the client's analytical specifications and requirements. Questions, raised in the review meeting, are discussed with the client for resolution. Exceptions to any requirements, if accepted by the client, are documented and incorporated into the QAPjP or project documentation records.

Non-standard specifications for individual clients are documented in the LIMS at the client account level or program level. Simple specifications are documented as comments for each project. Once entered into the LIMS, these specifications become memorialized for all projects related to the client account. Complex specifications are assigned program codes that link the specification to detailed analytical specifications.

Upon sample arrival, these specifications are accessed through a terminal or printed as a hard copy and stored in a binder for individuals who require access to the specification. Specifications that are not entered into the LIMS are prohibited unless documented in an interdepartmental memo, which clearly identifies the project, client and effective duration of the specification.

14.6 ***Operational Execution***. A work schedule is prepared for each analytical department on a daily basis. Analytical specifications or program codes from recently arrived samples have now been entered into the LIMS database. The database is sorted by analytical due date and holding time, into product specific groups. Samples are scheduled for analysis by due date and holding time. The completed schedule, which is now defined as a work list, is printed. The list contains the client requested product codes, program codes and specifications required for the selected sample(s). Special requirements are communicated to the analyst using the comments section or relayed through verbal instructions provided by the supervisor. The bench analyst assumes full responsibility for performing the analysis according to the specifications printed on the work sheet.

14.7 ***Verification***. Prior to the release of data to the client, the report generation staff review the report and compare the completed product to the client specifications documentation to assure that all requirements have been met. Project managers perform a spot check of projects with unique requirements to assure that the work was executed according to specifications.

15.0 CLIENT COMPLAINT RESOLUTION PROCEDURE

Requirement. The laboratory follows a formal system for managing and reconciling client complaints. The system includes procedures for documenting the complaint and communicating it to the appropriate department for resolution. The system also includes a quality assurance evaluation to determine if the complaint is related to systematic defects requiring corrective action and process changes.

15.1 ***Procedure***. Client complaints are communicated to client services representatives, quality assurance staff, or senior management staff for resolution. The individual receiving the complaint retains the responsibility for documentation and communicating the nature of the complaint to the responsible department(s) for resolution. The responsible party addresses the complaint. The resolution is communicated to quality assurance (QA) and the originator for communication to the client. QA reviews the complaint and resolution to determine if systematic defects exist. If systematic defects are present, QA initiates a corrective action for the responsible party who develops and implements a response that eliminates the defect. If systematic defects are not present and the resolution is satisfactory, the QA Staff will close the complaint/inquiry with a no further action is necessary tag.

15.2 ***Documentation***. Client's complaints are documented by the individual receiving the complaint using the Data Query and Corrective Action Inquiry Process. This process generates an E-Mail message that contains detailed information essential to the complaint resolution. A record of the telephone conversation is maintained by client services. The message is distributed to the QA staff and the party bearing responsibility for resolution by E-Mail. The complaint resolution is documented on the message by the responsible party and returned to the originator. A copy is sent to QA for review and database archiving.

15.3 ***Corrective Action***. Responses to data queries are required from the responsible party. At a minimum, the response addresses the query and provides an explanation to the complaint. Formal corrective action may focus on the single issue expressed in the complaint. Corrective action may include reprocessing of data, editing of the initial report, and re-issue to the client. If the QA review indicates a systematic error, process modification is required. The defective process at the root of the complaint is changed. SOPs are either created or modified to reflect the change. The party responsible for the process implements process changes.

15.4 ***QA Monitoring***. Process changes, implemented to resolve systematic defects, are monitored for effectiveness by QA. If monitoring indicates that the process change has not resolved the defect, QA works with the department management to develop and implement an effective process. If monitoring indicates that the defect has been resolved, monitoring is slowly discontinued and the corrective action is closed. Continued monitoring is incorporated as an element of the annual system audit.

16.0 CONTROL OF NONCONFORMING PRODUCT

Requirement: Policies and procedures have been developed and implemented that describe the procedures employed by the laboratory when any aspect of sample analysis or data reporting do not conform to established procedures or client specifications. These procedures include steps to ensure that process defects are corrected and affected work is evaluated to assess its impact to the client.

Procedure. Nonconforming product is identified through routine internal review and audit practices or through client inquiry. The individuals who identify the nonconformance or receiving a nonconformance inquiry immediately inform the Laboratory Director and the Quality Assurance Director. The Laboratory Director initiates an evaluation of the nonconformance through the Quality Assurance Department and takes full responsibility for managing the process and identifying the course of action to take, initiating corrective action and mitigating the impact of the nonconformance to the client. Reference SOP EQA 065 Control of Non-Conforming Product and EQA 038 Complaints & Data Inquiry for specific procedures on handling non-conformances and Data Inquires.

16.1 ***Corrective Action.*** The outcome of the evaluation dictates the course of action. This includes client notification when the quality of data reported has been impacted and may also include corrective action if applicable. Immediate corrective action is performed using the procedures specified in SGS Accutest Inc. SOP EQA011. However, additional action may be required including cessation of analysis and withholding and or recalling data reports. If the evaluation indicates that nonconforming data may have been issued to clients, the client is immediately notified and data may be recalled following the procedures specified in SOP EQA011. If work has been stopped because of a nonconformance, the Laboratory Director is the only individual authorized to direct a resumption of analysis.

Non-conformances caused by systematic process defects require retraining of the personnel involved as an element of the corrective action solution.

17.0 CONFIDENTIALITY PROTECTION PROCEDURES

Requirements: Policies and procedures have been developed to protect client data from release to unauthorized parties or accidental release of database information through accidental electronic transmission or illegal intrusion. These policies have been communicated to clients and staff. Electronic systems are regularly evaluated for effectiveness.

17.1 ***Client Anonymity***. Information related to the Company's clients is granted to employees on a "need to know" basis. An individual's position within the organization defines his "need to know". Individuals with "need to know" status are given password access to systems that contain client identity information and access to documents and document storage areas containing client reports and information. Access to client information by individuals outside of the Company is limited to the client and individuals authorized by the client.

Individuals outside of the Company may obtain client information through subpoena issued by a court of valid jurisdiction. Clients are informed when subpoenas are received ordering the release of their information.

Client information may be released directly to regulatory agencies without receiving client authorization under specified circumstances. These circumstances require that the regulatory agency have statutory authority under the regulations for laboratory certification and that SGS Accutest Inc.'s operations fall under the purview of the regulation. In these situations, SGS Accutest Inc. will inform the client of the regulatory agencies request for information pertaining to his data and proceed with the delivery of the information to the regulatory agency.

17.2 ***Documents***. Access to client documents is restricted to employees in need to know positions. Copies of all client reports are stored in secure electronic archives with restricted access. Reports and report copies are distributed to individuals who have been authorized by the client to receive them. Data reports or data are not released to third parties without verbally expressed or written permission from the client.

17.3 ***Electronic Data***.

Database Intrusion. Direct database entry is authorized for employees of SGS Accutest Inc. only on a need to know basis. Entry to the database is restricted through a user specific multiple password entry system. Direct access to the database outside the facility is possible through secured channels set up by SGS Accutest Inc. A unique password is required for access to the local area network. A second unique password is required to gain access to the database. The staff receives read or write level authorization on a hierarchical privilege basis.

Internet Access. Access to client information is through an HTTP Web application only. It does not contain a mechanism that allows direct access to the database. Clients can gain access to their data only using a series of SGS Accutest Inc. assigned client and user specific passwords. The viewable data, which is encrypted during transmission, consists of an extraction of database information only.

Client Accessibility. Accessibility to client data delivered via electronic means follows strict protocols to insure confidentiality. Clients accessing electronic data are assigned a company account. The account profile, which is established by the MIS staff, grants explicit access to specific information pertaining to the client's project activity. Passwords are assigned on an individual basis within a client account. These accounts can be activated or deactivated by the MIS staff only.

17.4 ***Information Requests***. Client specific data or information is not released to third parties without verbally expressed or written permission from the client. Written permission is required from third parties, who contact the Company directly for the release of information. Verbal requests will be honored only if they are received directly from the client. These requests must be documented in a record of communication maintained by the authorized recipient.

17.5 ***Transfer of Records***. Archived data, which has previously been reported and transmitted to clients, is the exclusive property of SGS Accutest Inc. In the event of a cessation of business activities due to business failure or sale, The Company's legal staff will be directed to arrange for the final disposition of archived data.

The final disposition of archived data will be accomplished using the approach detailed in the following sequence:

1. All data will be transferred to the new owners for the duration of the required archive period as a condition of sale.

2. If the new owners will not accept the data or the business has failed, letters will be sent to clients listed on the most recent active account roster offering them the option to obtain specific reports (identified by SGS Accutest Inc. Job Number) at their own expense.

3. A letter will be sent to the TNI Standard accrediting authority with organizational jurisdiction over the company offering them the option to obtain all unclaimed reports at their own expense.

4. All remaining archived data will be recycled using the most expedient means possible.

18.0 QUALITY AUDITS AND SYSTEM REVIEWS

Requirement: The quality assurance group conducts regularly scheduled audits of the laboratory to assess compliance with quality system requirements, technical requirements of applied methodology, and adherence to documentation procedures. The information gathered during these audits is used to provide feedback to senior management and perform corrective action where needed for quality improvement purposes.

18.1 ***Quality System Reviews***. Quality system reviews are performed annually by the Quality Assurance Director for the Company President. In this review, the laboratory is evaluated for compliance with the laboratory Quality Systems Manual (QSM) and the quality system standards of the National Environmental Laboratory Accreditation Conference. Findings, which indicate non-compliance or deviation from the QSM, are flagged for corrective action. Corrective actions require either a return to compliance or a plan change to reflect an improved quality process. The Quality Assurance Director is responsible for making and documenting changes to the QSM. These changes are reviewed by the Company President and The Laboratory Director prior to the approval of the revised system.

18.2 ***Quality System Audits.*** Quality system audits are conducted to evaluate the effectiveness and laboratory compliance with individual quality system elements. These audits are conducted on an established schedule. Audit findings are documented and communicated to the management staff and entered into the corrective action system for resolution. If necessary, retraining is conducted to assure complete understanding of the system requirements.

18.3 ***Test Method Assessments.*** Test Method Assessments are performed throughout the year following an established schedule. Selected analytical procedures are evaluated for compliance with standard operating procedures (SOPs) and method requirements. If non-conformances exist, the published method serves as the standard for compliance. SOPs are edited for compliance if the document does not reflect method requirements. Analysts are trained to the new requirements and the process is monitored by quality assurance. Analysts are retrained in method procedures if an evaluation of bench practices indicates non-compliance with SOP requirements.

18.4 ***Documentation Audits***. Documentation audits are conducted during routine internal audits. The audit includes a check of measurement processes that require manual documentation. It also includes checks of data archiving systems and a search to find and remove any inactive versions of SOPs that may still be present in the laboratory and being accessed by the analysts. Non-conformances are corrected on the spot. Procedural modifications are implemented if the evaluation indicates a systematic defect.

18.5 ***Corrective Action Monitoring***. Defects or non-conformances that are identified during client or internal audits are documented in the corrective action systems and corrected through process modifications and/or retraining. Once a corrective action has been designed and implemented, it is monitored for compliance on a regular basis by the QA staff. Spot corrections are performed if the staff is not following the new procedure. Monitoring of the corrective action continues until satisfactory implementation has been verified.

18.6 ***Preventive Action.*** Laboratory systems or processes, which may be faulty and pose the potential for non-conformances, errors, confusing reports or difficulties establishing traceability may be identified during internal audits. These items are highlighted for systematic change using the corrective action system and managed to resolution using the procedures for corrective action identified in EQA041.

18.7 ***Client Notification*.** Defective processes, systematic errors, and quality defects, detected during routine audits may have negative impacts on data quality. In some cases, data that has been released to clients may be affected. If defective data has been released for use, SGS Accutest Inc. will immediately notify the affected clients of the defect and provide specific details regarding the magnitude of the impact to their data.

18.8 ***Management Reports.*** Formal reports of all audit and proficiency testing activity are prepared for the management staff and presented as they occur. Additional reports may be presented orally at regularly scheduled staff meetings

Management reports may also address the following topics:

- Status and results of internal and external audits,
- Status and results of internal and external proficiency testing,
- Identification of quality control problems in the laboratory,
- Discussion of corrective action program issues,
- Status of external certifications and approvals,
- Status of staff training and qualifications,
- Discussion of new quality system initiatives.
- Recommendations for further action on listed items are included in the report.

19.0 HEALTH AND SAFETY

Requirement. The company operates a formal health and safety program that complies with the requirements of the Occupational Health and Safety Administration. The program consists of key policies and practices that are essential to safe laboratory operation. All employees are required to receive training on the program elements. Job specific training is conducted to assure safe practices for specific tasks. All employees are required to participate in the program, receive initial and annual training, and comply with the program requirements. All plan and program requirements are detailed in the Health and Safety Program Manual.

19.1 **Policy.** SGS Accutest Inc. Laboratories will provide a safe and healthy working environment for its employees and clients while protecting the public and preserving the Company's assets and property. The company will comply with applicable government regulations pertaining to safety and health in the laboratory and the workplace.

The objective of the SGS Accutest Inc. Health and Safety Program is to promote safe work practices that minimize the occurrence of injuries and illness to the staff through proper health and safety training, correct laboratory technique application and the use of engineering controls.

19.2 **Responsibilities.** The Health and Safety Program assists managers, supervisors and non-supervisory employees in control of hazards and risks to minimize the potential for employee and client injuries, damage to client's property and damage or destruction to SGS Accutest Inc.'s facility.

The Director, Health and Safety (EHS Director) is responsible for implementing the Program's elements and updating its contents as necessary. He/she also conducts periodic audits to monitor compliance and assess the program's effectiveness. The EHS Director is also responsible for creating and administering safety training for all new and existing employees.

The employee is responsible for following all safety rules established for their protection, the protection of others and the proper use of protective devices provided by the Company. The employee is also expected to comply with the requirements of the program at all times. Department Managers and Supervisors are responsible for ensuring the requirements of the Safety Program are practiced daily. The Company President retains the ultimate responsibility for the program design and implementation.

19.3 **Program Elements.** The SGS Accutest Inc. Health and Safety Program consists of key program elements that complement the company's health and safety objective. These elements form the essence of the health and safety policy and assure that the objectives of the program are achieved.

Safety Education and Training and Communication. Training is conducted to increase the staff's awareness of laboratory hazards and their knowledge of the safety practices and procedures required to protect them from those hazards. It is also used to communicate general safety procedures required for safe operation in a chemical laboratory.

Initial health and safety training for new employees is conducted during orientation. The training focuses on the SGS Accutest Inc. Safety and Health Program and includes specific training for the hazards that may be associated with the employees duties. Training is also conducted for all program elements focusing on general, acceptable, laboratory safety procedures. Targeted training is conducted to address hazards or safety procedures that are specific to individual employee's work assignments. All training activities are documented and archived in individual training folders. A health and safety training inventory is maintained in the training database.

Safety Committee. The safety committee provides the employee with an opportunity to express their views and concerns on safety issues in a forum where those concerns will be addressed. This committee meets monthly to assure that the interests of the company and the well being of the employee are protected. They also serve as a catalyst for elevating the level of safety awareness among their peers.

Hazard Identification and Communication. The hazard communication program enables employees to readily identify laboratory hazards and the procedures to protect themselves from those hazards. This program complies with OSHA's Hazard Communication Standard, Title 29 Code of Federal Regulations 1910.1200 that requires the company to adopt and adhere to the following key elements:

- Safety Data Sheets (SDS) must be available to any employee wishing to view them,
- The Company must maintain a Hazardous Chemicals Inventory (by location), which is updated on an annual basis,
- Containers are properly labeled,
- All employees must be provided with annual Hazard Communication and Right to Know training,

The hazard communication program also complies with the requirements of the New Jersey Worker and Community Right to Know Law, NJAC 8:95.

Identification of Workplace Hazards. The workplace hazard identification procedures have been designed to assure that hazards that have the potential to cause personnel injury or destruction of property are identified, managed and/or systematically eliminated from the operation. This system eliminates hazards, limits the potential for injury and increases the overall safety of the work environment.

Employee Exposure Assessment. Employee exposure assessment is performed to identify and evaluate potential exposure hazards associated with the employees work station. The exposure assessment data is used to determine if changes or modifications to the work station are needed to limit exposure to laboratory conditions that could negatively affect an employee's health or disclosed existing medical conditions.

Bloodborne Pathogens. SGS Accutest Inc. has implemented awareness training on the OSHA Bloodborne Pathogen Standard, 29CFR1910.1030 to reduce occupational exposure to Hepatitis B Virus (HBV), Human Immunodeficiency Virus (HIV) and other bloodborne pathogens that employees may encounter in their workplace.

Respiratory Protection Plan. The respiratory protection plan assures that SGS Accutest Inc. employees are protected from exposure to respiratory hazards. This program is used in situations where engineering controls and/or safe work practices do not completely control the identified hazards. In these situations, respirators and other protective equipment are used. Supplemental respiratory protection procedures are applied to specified maintenance personnel, employees who handle hazardous wastes in the hazardous waste storage area, and any employee that voluntarily elects to wear a respirator.

Chemical Hygiene Plan. The Chemical Hygiene Plan complies with the requirements of the Occupational Safety and Health Administration's Occupational Exposure to Hazardous Chemicals in the Laboratory Standard, 29 CFR 1910.1450. This plan establishes procedures, identifies safety equipment, personal protective equipment, and work practices that protect employees from the hazardous chemicals in the laboratory when properly used and applied.

Chemical Spill Response Plan. The chemical spill response plan has been designed to minimize the risks from a chemical spill or accidental chemical release in the laboratory. Risk minimization is accomplished through a planned response that follows a defined procedure. The designated staff have been trained to execute spill response procedures according to the specifications of the plan, which identifies the appropriate action to be taken based on the size of the spill.

Emergency Action & Evacuation Plan. The Emergency Action and Evacuation Plan details the procedures used to protect and safeguard SGS Accutest Inc.'s employees and property during emergencies. Emergencies are defined as fires or explosions, gas leaks, building collapse, hazardous material spills, emergencies that immediately threaten life and health, bomb threats and natural disasters such as floods, hurricanes or tornadoes, terrorism or terrorist actions. The plan identifies and assigns responsibility for executing specific roles in situations requiring emergency action. It also describes the building security actions coinciding with the "Alert Condition", designated by the Department of Homeland Security.

Lockout/Tagout Plan. Lockout/tagout procedures have been established to assure that laboratory employees and outside contractors take steps to render equipment inoperable and/or safe before conducting maintenance activities. The plan details the procedures for conducting maintenance on equipment that has the potential to unexpectedly energize, start up, or release energy or can be operated unexpectedly or accidentally resulting in serious injury to employees. The plan ensures that employees performing maintenance render the equipment safe through lock out or tag out procedures.

Personal Protection Policy. Policies have been implemented which detail the personal protection requirements for employees. The policy includes specifications regarding engineering controls, personal protective equipment (PPE), hazardous waste, chemical exposures, working with chemicals and safe work practices. Safety requirements specific to processes or equipment are reviewed with the department supervisor or the EHS Director before beginning operations.

Visitor and Contractor Safety Program. A safety brochure is given to all visitors and contractors who visit or conduct business at the facility. The brochure is designed to inform anyone who is not an employee of SGS Accutest Inc. of the laboratory safety procedures. The brochure directs them to follow all safety programs and plans while on SGS Accutest Inc. property. This program also outlines procedures for visitors and contractors in the event of an emergency. Visitors are required to acknowledge receipt and understanding of the SGS Accutest Inc. policy.

Appendix I

Glossary of Terms

GLOSSARY OF TERMS

Acceptance Criteria: specified limits placed on characteristics of an item, process, or service defined in requirement documents.

Accuracy: the degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.

Analyst: the designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

Audit: a systematic evaluation to determine the conformance to quantitative *and qualitative* specifications of some operational function or activity.

Batch: environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to 20 environmental samples of the same TNI Standard-defined matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group.

Blank: a sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results.

Blind Sample: a sub-sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process.

Calibration: to determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter, instrument, or other device. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements.

Calibration Curve: the graphical relationship between the known values, such as concentrations of a series of calibration standards and their instrument response.

Calibration Method: a defined technical procedure for performing a calibration.

Calibration Range: the range of concentrations between the lowest and highest calibration standards of a multi-level calibration curve. For metals analysis with a single-point calibration, the low-level calibration check standard and the high standard establish the linear calibration range, which lies within the linear dynamic range.

Calibration Standard: a substance or reference material used to calibrate an instrument.

Certified Reference Material (CRM): a reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation, which is issued by a certifying body.

Chain of Custody (COC): an unbroken trail of accountability that ensures the physical security of samples and includes the signatures of all who handle the samples.

Confirmation: verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to second column confirmation, alternate wavelength, derivatization, mass spectral, interpretation, alternative detectors or, additional cleanup procedures.

Continuing Calibration Verification (CCV): the verification of the initial calibration that is required during the course of analysis at periodic intervals. Continuing calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models.

Corrective Action (CA): the action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence.

Data Reduction: the process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form.

Demonstration of Capability (DOC): a procedure to establish the ability of the analyst to generate acceptable accuracy.

Documentation of Understanding (DOU): certifies that the analyst or technician has read and understood the procedures detailed in the Standard Operating Procedure (SOP) and will follow the SOP as written.

Document Control: the act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled to ensure use of the correct version at the location where the prescribed activity is performed.

Duplicate Analyses (DUP): the analyses or measurements of the variable of interest performed identically on two sub-samples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory.

Field of Testing: TNI Standard's approach to accrediting laboratories by program, method and analyte. Laboratories requesting accreditation for a program-method-analyte combination or for an up-dated/improved method are required submit to only that portion of the accreditation process not previously addressed (see TNI Standard, section 1.9ff).

Laboratory Control Sample-LCS (such as laboratory fortified blank, spiked blank, or QC check sample): a sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes from a source independent of the calibration standards or a material containing known and verified amounts of analytes. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

Limit of Detection (LOD): an estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte- and matrix-specific. DoD clarification is the smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate (Type II error) is 1%.

Limit of Quantitation (LOQ): the minimum levels, concentrations, or quantities of a target analyte that can be reported with a specified degree of confidence. DoD clarification is the lowest concentration that produces a quantitative result within specified limits of precision and bias. The LOQ shall be at or above the concentration of the lowest initial calibration standard.

Matrix: the component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

Aqueous: any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.

Drinking Water: any aqueous sample that has been designated a potable or potential potable water source. Saline/Estuarine: any aqueous sample from an ocean or estuary, or other salt-water source such as the Great Salt Lake. Non-aqueous Liquid: any organic liquid with <15% settleable solids.

Solids: includes soils, sediments, sludges and other matrices with >15% settleable solids.

Chemical Waste: a product or by-product of an industrial process that results in a matrix not previously defined.

Air: whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbent tube, impinger solution, filter, or other device.

Biota: animal or plant tissue, consisting of entire organisms, homogenates, and/or organ or structure specific subsamples.

Matrix Spike-MS (spiked sample or fortified sample): a sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix Spike Duplicate -MSD (spiked sample or fortified sample duplicate): a second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.

Method Blank (MB): a sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest, which is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.

Method Detection Limit (MDL): the minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

National Environmental Laboratory Accreditation Program (NELAP): the overall National Environmental Laboratory Accreditation Program.

NELAP Standards: the plan of procedures for consistently evaluating and documenting the ability of laboratories performing environmental measurements to meet nationally defined standards established by the National Environmental Laboratory Accreditation Conference.

Performance Audit: the routine comparison of independently obtained *qualitative and quantitative* measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory.

Precision: the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms.

Preservation: refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample.

Proficiency Testing: a means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source.

Proficiency Test Sample (PT): a sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria.

Quality Assurance: an integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.

Quality Control (QC): the overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users.

Quality Manual: a document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.

Quality System: a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC.

Reporting Limits (RL): the maximum or minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be quantified with the confidence level required by the data user.

Reagent Blank (method reagent blank or method blank): a sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps.

Reference Material: a material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.

Reference Method: a method of known and documented accuracy and precision issued by an organization recognized as competent to do so.

Reference Standard: a standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived.

Replicate Analyses: the measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval.

Sample Duplicate (SD): two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method including sampling and analysis.

Spike: a known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

Standard: the document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of TNI Standard and meets the approval requirements of TNI Standard procedures and policies.

Traceability: the property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons.

Validation: the process of substantiating specified performance criteria.

Work Cell: A defined group of analysts that together perform the method analysis. Members of the group and their specific functions within the work cell must be fully documented. A "work cell" is considered to be all those individuals who see a sample through the complete process of preparation, extraction, or analysis. The entire process is completed by a group of capable individuals; each member of the work cell demonstrates capability for each individual step in the method sequence.

Appendix II

Standard Operating Procedures Directory

SGS Accutest Inc. Laboratories
Standard Operating Procedures

Section	Standard Operating Procedure Title	Number
Air Toxics	Air Analysis by TO-15	EAT001
Air Toxics	Summa Canister Cleaning and Certification	EAT002
Air Toxics	Air Analysis of Tedlar Bag/Summa Canister by TO-3	EAT003
Air Toxics	Laboratory Analysis of Dissolved Gases in Aqueous Samples	EAT004
Air Toxics	Air Analysis by NJDEP – SRWM Low Level USEPA TO-15	EAT005
Air Toxics	Calibration of Flow Controllers	EAT006
Air Toxics	Air Analysis by TO-15 for Minnesota Department of Health	ETA007
General Chem	Percent Solids - SM2540 G-97, ASTM D4643-00	EGN007
General Chem	Anionic Surfactants As MBAS	EGN008
General Chem	Nonionic Surfactants as CTAS	EGN009
General Chem	Total Solids, 160.3, SM2540 B-97	EGN010
General Chem	Composite Sample	EGN015
General Chem	Total Dissolved Solids (Total Filterable Residue) SM2540 C-97	EGN020
General Chem	Settleable Solids, 160.5	EGN021
General Chem	Nitrate/Nitrite & Nitrate Only By Cad. Red. Analysis	EGN026
General Chem	Total Volatile Solids, 160.4	EGN030
General Chem	Chlorine, Total Residual And Free	EGN033
General Chem	Total Alkalinity, 310.1	EGN037
General Chem	Acidity (pH 8.2)	EGN044
General Chem	Bicarbonate, Carbonate, Free Carbon Dioxide	EGN045
General Chem	Viscosity	EGN067
General Chem	Total Suspended Solids (Non-Filterable Residue)	EGN087
General Chem	Chemical Oxygen Dem: Hach 8000, Aqueous Samples - Soil Modified	EGN099
General Chem	Hardness As Caco3 By Titration	EGN101
General Chem	Orthophosphate	EGN102
General Chem	Nitrogen, Nitrite -Total-Waters/Soluble-Soils	EGN103
General Chem	Turbidity, 180.1	EGN116
General Chem	Sulfide	EGN118
General Chem	Sulfite.	EGN119
General Chem	Apparent Color By Visual Comparison Method	EGN120
General Chem	Specific Conductance At 25.0 C	EGN124
General Chem	Chloride	EGN131
General Chem	Turbidity for Metals Drinking Waters	EGN132
General Chem	Odor & Odor at Elevated Temp.(Threshold Odor Test)	EGN133
General Chem	Biological Oxygen Demand (5 Day BOD)	EGN134
General Chem	Winkler Titration For DO Standardization	EGN135
General Chem	Dissolved Oxygen	EGN136
General Chem	Reactive Sulfide And Reactive Cyanide	EGN137
General Chem	Ignitability	EGN140
General Chem	TCLP - Semi-volatiles/Metals Extraction	EGN141
General Chem	TCLP- Volatiles Extraction	EGN142
General Chem	Paint Filter Test	EGN143
General Chem	Cyanides Amenable To Chlorination Preparation	EGN144
General Chem	Temperature	EGN146

SGS Accutest Inc. Laboratories
Standard Operating Procedures

Section	Standard Operating Procedure Title	Number
General Chem	Iodine, Colorimetric Analysis	EGN148
General Chem	pH by Electrode – Water	EGN151
General Chem	Salinity - SM182520B	EGN158
General Chem	pH & Corrosivity for Soils/ Solid Wastes SW486 9045	EGN200
General Chem	BTU (Gross Calorific Value)	EGN202
General Chem	Percent Sulfur	EGN203
General Chem	Bulk Density (Dry Basis)	EGN204
General Chem	Percent Ash (Dry Basis)	EGN205
General Chem	Total Organic Content	EGN206
General Chem	Cyanide (Lachat Autoanalyzer)	EGN207
General Chem	Total Chlorine ASTM D808-91	EGN208
General Chem	Total Organic Chlorine ASTM D808-91	EGN209
General Chem	Total Kjeldahl Nitrogen (Lachat Autoanalyzer)	EGN210
General Chem	Specific Gravity	EGN211
General Chem	Hexavalent Chromium (Soils)	EGN214
General Chem	Ammonia (Lachat Autoanalyzer)	EGN216
General Chem	Phenols (Lachat Autoanalyzer)	EGN217
General Chem	Total Organic Halides	EGN218
General Chem	Total Organic Halides, Solid And Oil Matrices	EGN219
General Chem	Pour Point	EGN221
General Chem	Base Sediment In Petroleum Samples	EGN222
General Chem	Water Content In Petroleum Samples	EGN223
General Chem	Ignitability, Bunsen Burner Method	EGN226
General Chem	Organic Matter (Loss on Ignition)	EGN227
General Chem	Sulfide Analysis For Reactive Sulfides	EGN228
General Chem	Hexavalent Chromium In Waters by EPA 7196a Mod.	EGN230
General Chem	Hexavalent Chromium In Waters by SM18 4500 CR D	EGN231
General Chem	Total Organic Carbon In Soil Samples	EGN233
General Chem	Total Organic Carbon In Aqueous Samples	EGN234
General Chem	pH and Corrosivity for Aqueous and Multiphasic Wastes	EGN238
General Chem	Synthetic Precipitation Leaching Procedure for Non-Volatile Anal.	EGN239
General Chem	Synthetic Precipitation Leaching Procedure for Volatile Analytes	EGN240
General Chem	Cation Exchange Capacity Of Soils (Sodium Acetate)	EGN242
General Chem	Ferrous Iron	EGN243
General Chem	Specific Gravity (For Sludges And Solids)	EGN247
General Chem	N-Hexane Extract. Mat. & Silica Gel Treatment by Gravimetric Anal.	EGN249
General Chem	Oil & Grease – Gravimetric Anal. (So & Sl) – Hexane Extraction	EGN250
General Chem	Neutral Leaching of Solid Waste Sam. Using Shake Extraction	EGN252
General Chem	Oxidation-Reduction Potential	EGN253
General Chem	Titrimetric Method For Free Carbon Dioxide	EGN255
General Chem	Total Phosphorous EPA 365.3	EGN256
General Chem	Dissolved Silica	EGN257
General Chem	Grain Size and Sieve Testing	EGN258
General Chem	Hardness By Calculation	EGN259

SGS Accutest Inc. Laboratories
Standard Operating Procedures

Section	Standard Operating Procedure Title	Number
General Chem	Spectrophotometer Calibration Check	EGN260
General Chem	Massachusetts Sieve Test	EGN262
General Chem	Volatile Suspended Solids	EGN264
General Chem	Unburned Combustibles (Volatile Solids)	EGN266
General Chem	Particulate Matter	EGN267
General Chem	Elutriate Preparation	EGN268
General Chem	Phosphorus, Hydrolyzable	EGN271
General Chem	Perchlorate by Ion Chromatography in Groundwater and Soil	EGN272
General Chem	Percent Lipids by Gravimetric Analysis	EGN273
General Chem	Cyanide Distillation/Aqueous Samples/Micro Method	EGN275
General Chem	Cyanide Distillation/Soil Samples/Micro Method	EGN276
General Chem	Calibration of General Chemistry Distillation Tubes	EGN277
General Chem	Phenols Distillation, Water Samples	EGN279
General Chem	Phenols Micro Distillation, Soil Samples	EGN280
General Chem	Inorganic Anions Determination by ion chromatography using IC 2000	EGN281
General Chem	Leaching of Solid Waste Samples using China Leaching Procedure	EGN283
General Chem	Ammonia Distillation, Water & Solid samples	EGN284
General Chem	Weak Acid Dissociable Cyanide / Micro-Distillation Method	EGN286
General Chem	Ferrous Iron for Hexavalent Chromium Sample Characterization	EGN288
General Chem	Calibration of Coliform Collection Bottles	EGN287
General Chem	Inorganic Carbon by Calculation	EGN289
General Chem	Procedure for Homogenization of Biota Samples	EGN290
General Chem	Hexavalent Chromium in Water by Ion Chromatography	EGN291
General Chem	Hexavalent Chromium in Soils by Ion Chromatography	EGN292
General Chem	Procedure for Wand Mixer Homogenization of Soil Samples	EGN293
General Chem	Hydrogen Sulfide	EGN294
General Chem	TCLPME-Multiple Extractions Procedure	EGN295
General Chem	Modified Elutriate Preparation	EGN296
General Chem	Procedure for Particle Size Reduction (Crushing) of Solid Matrices	EGN297
General Chem	Acid Volatile Sulfides	EGN298
General Chem	Pore Water Extraction from Soils for NVOC and Metals Analysis	EGN299
General Chem	Iodide, Colorimetric Analysis	EGN300
General Chem	Percent Solids and Moisture in Soil/Solid Matrices	EGN301
General Chem	Un-Ionized Ammonia	ENG302
General Chem	Density, ASTM Definition	EGN303
General Chem	HEM by Gravimetric Analysis Using Solid Phase Extraction	EGN304
General Chem	Hexavalent Chromium on Wipe Samples	EGN305
General Chem	Modified Mehlich Buffer pH	EGN306
General Chem	Screening Procedure to test for presence of sulfide	EGN307
General Chem	Black Carbon in Soil Samples	EGN308
General Chem	Physical Appearance (Sample Description)	EGN309
General Chem	Orthophosphate	EGN310
General Chem	Oxidizer Screen	EGN311
General Chem	Hexavalent Chromium by 218.7	EGN312
Facilities Maint.	Facilities Maintenance	EFM001

SGS Accutest Inc. Laboratories
Standard Operating Procedures

Section	Standard Operating Procedure Title	Number
Field Operations	Aqueous Grab Sampling Procedures	EFP001
Field Operations	Use of Automatic Wastewater Sampler	EFP002
Field Operations	Free and Total residual Chlorine	EFP003
Field Operations	Decontamination of Sampling Equipment	EFP004
Field Operations	Dissolved Oxygen	EFP005
Field Operations	Dissolved Oxygen by Winkler Titration	EFP006
Field Operations	Metal Sample Field Filtering Procedure	EFP008
Field Operations	Sampling Procedure for Monitoring Wells	EFP013
Field Operations	Subsurface Soil Sampling Procedure	EFP016
Field Operations	Surface Soil Sampling Procedure	EFP017
Field Operations	Residential Potable Well Sampling Procedure	EFP018
Field Operations	Potable Water Line Sampling Procedure	EFP019
Field Operations	Sampling for NJ Private Well Testing Act	EFP020
Field Operations	Field Sampling Coordinates by GPS	EFP021
Field Operations	Sampling Drinking Water Wells for Volatile Organics	EFP022
Field Operations	Sampling Drinking Water Wells for Metals	EFP023
Field Operations	Sampling Drinking Water Wells for Nitrates & Nitrites	EFP024
Field Operations	Sampling Drinking Water Wells for Gross Alpha	EFP025
Field Operations	Sampling Drinking Water Wells for Coliform Bacteria	EFP026
Field Operations	Sampling Drinking Water Wells for pH	EFP027
Field Operations	Documentation Requirements for Field Services	EFP028
Field Operations	Field Oxidation-Reduction Potential	EFP029
Field Operations	Turbidity, Field Test	EFP030
Field Operations	Analysis for Dissolved Oxygen by DO Probe	EFP031
Field Operations	Field pH in Water by Electrode	EFP032
Field Operations	Field Measurement of Specific Conductance and Resistivity	EFP033
Health & Safety	Contamination Avoidance Procedure	EHS001
Health & Safety	Measuring Face Velocities in Laboratory Fume Hoods	EHS002
Health & Safety	Proper Handling of Compressed Gas Cylinders	EHS003
Health & Safety	Sample and Waste Disposal (Formerly ESM003)	EHS004
Health & Safety	Handling and Management of Inorganic Wastes (Formerly EGN265)	EHS005
Health & Safety	Handling, Treatment, and Disposal of Foreign Soils	EHS006
Health & Safety	Management of Industrial Product Samples	EHS007
Health & Safety	Organic Prep Air Monitoring	EHS008
Health & Safety	Laboratory Visitor Safety Procedure	EHS009
Information Tech	Information Security & Integrity Procedure	EMI001
Information Tech	Procedures for Requesting Software or Software Revisions	EMI002
Information Tech	Development, Implementation, Delivery, & Revision of EDDs	EMI003
Information Tech	Data Systems Maintenance and Information Handling	EMI006
Metals Analysis	Mercury Analysis of Non-Potable and Potable Water Samples	EMA215
Metals Analysis	Metals by ICP-MS: EPA 200.8	EMA216

SGS Accutest Inc. Laboratories
Standard Operating Procedures

Section	Standard Operating Procedure Title	Number
Metals Analysis	Metals by ICP-MS: SW846 6020	EMA217
Metals Analysis	Metals by ICP Atomic Emission Spectrometry using Solid State ICP	EMA222
Metals Analysis	Metals by ICP Atomic Emission Spectrometry – EPA 200.7	EMA223
Metals Analysis	Low Level Mercury by EPA 1631	EMA224
Metals Analysis	Low Level Mercury by EPA 245.7	EMA225
Metals Analysis	Metals by inductively coupled plasma-Mass Spectrometry (ICP-MS)	EMA226
Metals Analysis	Metals by Inductively coupled plasma atomic emission spectrometry (ICP) using Using Solid State ICP	EMA227
Metals Analysis	Cold Vapor Analysis of Mercury For Soil Samples	EMA228
Metals Prep	Digestion of DW for ICP Analysis	EMP048
Metals Prep	Non-Potable Waters Digestion For ICP/Flame Analysis	EMP070
Metals Prep	Soil Digestion For ICP Analysis	EMP073
Metals Prep	Non-Potable Water Digestion for Flame/ICP (Total & Dissolved)	EMP081
Metals Prep	Digestion Of Non-Potable Waters For Total Recoverable Metals	EMP200
Metals Prep	Metals Spiking Solution and Standards Preparation and Use	EMP202
Metals Prep	Calibration of Metals Digestion Tubes	EMP203
Metals Prep	ICP and ICP/MS Analysis of TPPM-10 Filters	EMP207
Metals Prep	Digestion of Waters for Acid Extractable Metals	EMP208
Metals Prep	Lab Preservation Filtration of Metals Samples	EMP209
Microbiology	Microbiological Quality Control	EMB001
Microbiology	Coliform, Total By Colilert, SM18 9223 B	EMB002
Microbiology	Total Coliform: Membrane Filtration/Fecal Coliform Confirmation	EMB003
Microbiology	Total Plate Count SM18 9215B	EMB008
Microbiology	General Petroleum Degraders	EMB009
Microbiology	Calibration of Microbiology Coliform Collection Bottles	EMB010
Microbiology	Coliform, Fecal	EMB127
Organics-GC	Dibromo-3-chloropropane & 1,2,3-Trichloropropane	EGC504
Organics-GC	Acrolein and Acrylonitrile by EPA 603	EGC603
Organics-GC	Pesticides & PCBs in Wastewater by EPA 608	EGC608
Organics-GC	1,2-DBE, 1,2-DB-3-CP & 1,2,3-TCP by Micro-extraction and GC	EGC8011
Organics-GC	Pesticides Analysis by SW8081	EGC8081
Organics-GC	PCB Analysis SW8082	EGC8082
Organics-GC	Herbicides by SW846 – 8151	EGC8151
Organics-GC	Conn. Total Semi-volatile Petroleum Hydrocarbons	EGCCTGRO
Organics-GC	Alcohols by Direct Aqueous Injection GC/FID SW 8015	EGCALDAI
Organics-GC	Analysis of Explosives by GC/ECD	EGCBUSACH-PPM
Organics-GC	Connecticut Extractable Petroleum Hydrocarbon Analysis	EGCCTETPH
Organics-GC	Petroleum Range Organics Analysis By GC/FID (Florida)	EGCFLPRO
Organics-GC	Massachusetts Extractable Petroleum Hydrocarbons	EGCMAEPH
Organics-GC	Massachusetts Volatile Petroleum Hydrocarbons	EGCMAVPH
Organics-GC	New Jersey Extractable Petroleum Hydrocarbons	EGCNJEPH

SGS Accutest Inc. Laboratories
Standard Operating Procedures

Section	Standard Operating Procedure Title	Number
Organics-GC	Oil Identification by Gas Chromatography Fingerprint	EGCOILID
Organics-GC	Texas Total Petroleum Hydrocarbons	EGCTX1005
Organics-GC	Wisconsin Diesel Range Organics	EGCWIDRO
Organics-GC/MS	Volatile Organics in Drinking Water by EPA 524	EMS524
Organics-GC/MS	Volatile Organics in Wastewater by EPA 624	EMS624
Organics-GC/MS	Semi-Volatile Organics by EPA 625	EMS625
Organics-GC/MS	Volatile Organics by SW8260B	EMS8260B
Organics-GC/MS	Ethylene/Propylene Glycol Analysis DAI-GC/MS(SIM)	EMS8260DAI
Organics-GC/MS	Semi-Volatile Organics by SW8270	EMS8270
Organics-GC/MS	NDMA By chemical Ionization Gas Chromatography/mass spectrometry (GC/MS) With large volume injection	EMSNDMA
Organics Prep	Prep of Base Neutral/Acid Extractables: Water Matrices	EOP001
Organics Prep	Extraction of Semivolatile Organics from Solids By Sonication	EOP003
Organics Prep	Alumina Cleanup of Organic Extracts: SW3610	EOP005
Organics Prep	Continuous Liquid/Liquid Extraction Water: SW3520C	EOP007
Organics Prep	Sulfur Cleanup of Organic Extracts: SW846 3660B	EOP011
Organics Prep	Testing & Approval Of Organics Solvents	EOP013
Organics Prep	Preparation & Use of MDL Check Solution	EOP014
Organics Prep	Preparation of Petroleum Oils & Organic Wastes for PCBs by SW 8082	EOP017
Organics Prep	Removal of Sulfur from Extracts with Tetrabutylammonium Sulfite	EOP018
Organics Prep	Soxhlet Extraction of Solids For Semi-Volatile Organics	EOP020
Organics Prep	Preparation of Petroleum Products for EPA 8081	EOP021
Organics Prep	Preparation of Petroleum Products for BNA by EPA 8270C	EOP022
Organics Prep	Preparation for Aqueous DRO for Wisconsin	EOP023
Organics Prep	Solvent Extraction for Soil/Sediment DRO for Wisconsin	EOP024
Organics Prep	Pressurized Fluid Extraction (ASE)	EOP040A
Organics Prep	Microwave Extraction of Pesticides &/or PCBs from solid samples	EOP3546
Organics Prep	Calibration of Extract Vials	EOP026
Organics Prep	Alumina Column Cleanup SW3611	EOP3611
Organics Prep	Florisil Column Cleanup SW3620	EOP3620
Organics Prep	Silica Gel Cleanup SW3630	EOP3630
Organics Prep	Acid Base Partitioning SW3650	EOP3650
Organics Prep	Sulfuric Acid/Permanganate Cleanup SW3665	EOP3665
Organics Prep	Purge-And-Trap Extraction Of Aqueous Samples	EOP5030
Organics Prep	Collection/Preservation of Solids for VO Analysis: 5035	EOP5035
Organics Prep	Cleanup of Organic Extracts by Gel Permeation Chromatography	EOPGPC
Project Mgmt	Procedure For The Management Of Client Projects	EPM001
Project Mgmt	Client Specific Method Modifications	EPM002
Project Mgmt	Procedure For The Notification Of DW Exceedences	EPM003
Project Mgmt	Data Entry for Sample Log-In	EPM004
Project Mgmt	Subcontracting high volume	EPM005-01

SGS Accutest Inc. Laboratories
Standard Operating Procedures

Section	Standard Operating Procedure Title	Number
Quality Assurance	Preparation, Approval, Distribution & Archiving of SOPs	EQA001
Quality Assurance	Calibration of Analytical Balances	EQA002
Quality Assurance	Calibration of Thermometers	EQA003
Quality Assurance	Calibration and Use of Auto-Pipettes	EQA004
Quality Assurance	Temperature Monitoring-	EQA005
Quality Assurance	Sample Container Cleaning & Quality Control	EQA006
Quality Assurance	Calibration of Kuderna-Danish Collection Tubes	EQA007
Quality Assurance	Preparation and Analysis of Sample Preservatives	EQA008
Quality Assurance	Personnel Training and Analyst Proficiency	EQA009
Quality Assurance	Sample Batching Procedure	EQA010
Quality Assurance	Corrective Action Procedure	EQA011
Quality Assurance	Glassware Preparation For Inorganic Lab Use	EQA012
Quality Assurance	Preparation Of Glassware For Organics Extraction	EQA013
Quality Assurance	Standards Traceability Documentation Procedure	EQA014
Quality Assurance	Template for Standard Operating Procedures	EQA016
Quality Assurance	Management/Reporting Of Proficiency Test (PT) Samples	EQA017
Quality Assurance	Creating/Distributing/Tracking Internal Chains Of Custody	EQA018
Quality Assurance	Creating New Accounts	EQA019
Quality Assurance	Creating New Projects	EQA020
Quality Assurance	Creating Product Codes	EQA021
Quality Assurance	Procedures For The Purchase Of Laboratory Supplies	EQA023
Quality Assurance	Control & Archiving Of Laboratory Documents	EQA025
Quality Assurance	Confidentiality Protection Procedures	EQA027
Quality Assurance	Quality System Review	EQA028
Quality Assurance	Contract Review	EQA029
Quality Assurance	Procedure for the Development and Application of MDLs and RLs	EQA030
Quality Assurance	Subcontracting Procedures	EQA031
Quality Assurance	Signature Authority	EQA032
Quality Assurance	Review of Inorganic Data	EQA034
Quality Assurance	Review of Organic Data	EQA035
Quality Assurance	Documentation of Equipment Maintenance	EQA036
Quality Assurance	Procedures for Accepting Departures from Laboratory Specifications	EQA037
Quality Assurance	Client Complaints Resolution Procedure	EQA038
Quality Assurance	Employee Technical Ethics Responsibilities	EQA039
Quality Assurance	Internal Audit Procedure	EQA041
Quality Assurance	Procedure for Obtaining Representative Sample Aliquots	EQA042
Quality Assurance	Procedure for Development &use of In-House Q C Criteria	EQA043
Quality Assurance	Manual Integration of Chromatographic Peaks	EQA044
Quality Assurance	Deionized Water Quality Control	EQA046
Quality Assurance	Management and Control of Change	EQA047
Quality Assurance	Laboratory Equipment Purchase and Removal From Service	EQA048
Quality Assurance	Calibration of Microliter Syringes	EQA049
Quality Assurance	Autosampler Vial Labeling Procedure (formally EOP041-01)	EQA050
Quality Assurance	pH for Volatile Samples	EQA051
Quality Assurance	Quality Control Review of Data Packages	EQA054
Quality Assurance	Procedures for Determining Method Comparability	EQA055
Quality Assurance	Refrigerator Storage Holding Blank Procedure	EQA056

SGS Accutest Inc. Laboratories
Standard Operating Procedures

Section	Standard Operating Procedure Title	Number
Quality Assurance	Data Integrity Training Procedure	EQA057
Quality Assurance	Data Integrity Monitoring Procedure	EQA058
Quality Assurance	Procedure for Conducting Data Integrity Investigations	EQA059
Quality Assurance	Quality Control Requirements for Organics by GC/GCMS using EPA 500 & 600 Series, SW846 8000 Series and CLP Methodologies	EQA060
Quality Assurance	Procedure for the Confidential Reporting of Data Integrity Issues	EQA061
Quality Assurance	Calibration of Volumetric Dispensers for Volume Critical Processes	EQA062
Quality Assurance	Calibration of Volumetric Dispensers / Non-Critical Volumes Processes	EQA063
Quality Assurance	Glassware Preparation for use in VOA analysis	EQA064
Quality Assurance	Control of Non-Conforming Product	EQA065
Quality Assurance	Client Notification of Key Personnel Changes	EQA066
Quality Assurance	Review of Inorganic Notebooks	EQA067
Quality Assurance	Disposal of Spent Semi-Volatile Organic Extracts	EQA068
Quality Assurance	Compressed Gas Management	EQA069
Quality Assurance	Procedure for Tracking Quality Control Non-Conformances	EQA070
Quality Assurance	Procedure for the Development and Application of Experimental Method Detection Limits, limits of detection, and limits of quantitation for inorganic applications	EQA071
Quality Assurance	Procedure for Particle Size Reduction (Crushing)/Homogenization of solid matrices	EQA072
Quality Assurance	Compositing Samples	EQA073
Report Generation	Report Generation–Data Package	ERG002
Sample Mgmt.	Sample Storage	ESM001
Sample Mgmt.	Chain Of Custody And Log In Procedure	ESM002
Sample Mgmt.	Temperature Maintenance Of Shipping Coolers	ESM004
Sample Mgmt.	Cooler Packaging And Shipping Procedure	ESM008
Sample Mgmt.	Procedures for Sample Couriers	ESM011
Sample Mgmt.	Summa Canister Shipment & Retrieval: NJDEP 03-X-35135	ESM012

Appendix III

Analytical Capabilities

Method Capabilities by NELAP Accredited Fields of Testing

Analytes	Method Number	Program	Chemistry Field
Alkalinity	SM 2320 B-11	Drinking Water	Inorganic Analysis
Ammonia	SM 4500-NH_3 H-11	Drinking Water	Inorganic Analysis
Chloride, Fluoride, Sulfate	EPA 300.0	Drinking Water	Inorganic Analysis
Chlorine, Total Residual	SM 4500-CL F-11	Drinking Water	Inorganic Analysis
Color, Apparent	SM 2120 B-11	Drinking Water	Inorganic Analysis
Conductivity	SM 2510 B-11	Drinking Water	Inorganic Analysis
Cyanide	EPA 335.4	Drinking Water	Inorganic Analysis
Foaming Agents (MBAS)	SM 5540 C-11	Drinking Water	Inorganic Analysis
Nitrate	EPA 353.2	Drinking Water	Inorganic Analysis
Nitrite	SM 4500-NO_2 B	Drinking Water	Inorganic Analysis
Odor	SM 2150 B-11	Drinking Water	Inorganic Analysis
Organic Carbon, Total (TOC)	SM 5310 B-11	Drinking Water	Inorganic Analysis
Dissolved Organic Carbon (DOC)	5310 B, C, D	Drinking Water	Inorganic Analysis
Orthophosphate	SM 4500-P E-11	Drinking Water	Inorganic Analysis
Perchlorate	EPA 314.0	Drinking Water	Inorganic Analysis
pH, Hydrogen Ion	SM 4500-H^+ B-11	Drinking Water	Inorganic Analysis
Silica, Dissolved	SM 4500-Si D(18^{th}/19^{th} ed)	Drinking Water	Inorganic Analysis
Temperature	SM 2550 B	Drinking Water	Inorganic Analysis
Total Dissolved Solids	SM 2540 C-11	Drinking Water	Inorganic Analysis
Total Organic Halides (TOX)	SM 5320 B	Drinking Water	Inorganic Analysis
Turbidity	EPA 180.1	Drinking Water	Inorganic Analysis
Hardness, Calcium	EPA 200.7	Drinking Water	Metals Analysis
Hardness, Total	EPA 200.7	Drinking Water	Metals Analysis
Hardness, Total	SM 2340 C-11	Drinking Water	Metals Analysis
Mercury	EPA 245.1	Drinking Water	Metals Analysis
Metals	EPA 200.7	Drinking Water	Metals Analysis
Metals	EPA 200.8	Drinking Water	Metals Analysis
DBCP, EDB & TCP	EPA 504.1	Drinking Water	Organics Analysis
Volatile Organics	EPA 524.2	Drinking Water	Organics Analysis
Total Coliform/E. Coli	SM 9223 B	Drinking Water	Microbiology
Heterotrophic Bacteria	SM 9215 B	Drinking Water	Microbiology

Method Capabilities by NELAP Accredited Fields of Testing

Analytes	Method Number	Program	Chemistry Field
Acidity as $CaCO_3$	SM 2310 B-11	Wastewater	Inorganic Analysis
Alkalinity as $CaCO_3$	SM 2320 B-11	Wastewater	Inorganic Analysis
Ammonia	SM20 4500-NH_3-B+H-11	Wastewater	Inorganic Analysis
Biochemical Oxygen Demand	SM 5210 B-11	Wastewater	Inorganic Analysis
Bromide, Chloride, Fluoride, Sulfate	EPA 300.0	Wastewater	Inorganic Analysis
Carbonaceous BOD (CBOD)	SM 5210 B-11	Wastewater	Inorganic Analysis
Chemical Oxygen Demand (COD)	SM 5220 B or C-11	Wastewater	Inorganic Analysis
Chloride	SM 4500-Cl C-11	Wastewater	Inorganic Analysis
Chlorine, Total Residual	SM 4500-Cl F-11	Wastewater	Inorganic Analysis
Chromium (VI)	SM 3500-Cr B-11	Wastewater	Inorganic Analysis
Chromium (VI)	EPA 218.7	Wastewater	Inorganic Analysis
Color, Apparent	SM 2120 B-11	Wastewater	Inorganic Analysis
Cyanide (Sample Preparation)	SM 4500-CN C+E-11	Wastewater	Inorganic Analysis
Cyanide (Analytical Finish)	EPA 335.4	Wastewater	Inorganic Analysis
Cyanide Amenable to Chlorine	SM 4500-CN-B or C-11+G-11	Wastewater	Inorganic Analysis
Hardness, Total as $CaCO_3$	SM 2340C-11	Wastewater	Inorganic Analysis
Iron, Ferrous	SM 3500-Fe B-11	Wastewater	Inorganic Analysis
Kjeldahl Nitrogen, Total	EPA 351.2	Wastewater	Inorganic Analysis
Nitrate/Nitrite	EPA 353.2	Wastewater	Inorganic Analysis
Nitrite	SM 4500-NO_2 B-11	Wastewater	Inorganic Analysis
Oil & Grease, HEM-LL	EPA 1664A	Wastewater	Inorganic Analysis
Oil & Grease, SGT-HEM, Non-Polar	EPA 1664A	Wastewater	Inorganic Analysis
Organic Nitrogen	SM 4500-N B+G EPA 351.2	Wastewater	Inorganic Analysis
Orthophosphate	EPA 365.3	Wastewater	Inorganic Analysis
Oxygen, Dissolved, Winkler	SM 4500-O C-11	Wastewater	Inorganic Analysis
Oxygen, Dissolved	SM 4500-O G-11	Wastewater	Inorganic Analysis
pH Hydrogen Ion	SM 4500-H B-11	Wastewater	Inorganic Analysis
pH Aqueous Electrometric	SW-846 9040C	Wastewater	Inorganic Analysis
Temperature Thermometric	SM 2550 B-00	Wastewater	Inorganic Analysis
Phenols	EPA 420.4	Wastewater	Inorganic Analysis
Phenols (Analytical Finish)	SW846 9066	Wastewater	Inorganic Analysis
Phosphorus (Total)	EPA 365.3	Wastewater	Inorganic Analysis
Residue, Filterable (TDS)	SM 2540 C-11	Wastewater	Inorganic Analysis
Residue, Nonfilterable (TSS)	SM 2540 D-11	Wastewater	Inorganic Analysis

Method Capabilities by NELAP Accredited Fields of Testing

Analytes	Method Number	Program	Chemistry Field
Residue, Settleable	SM 2540 F-11	Wastewater	Inorganic Analysis
Residue, Total	SM 2540 B-11	Wastewater	Inorganic Analysis
Residue, Volatile	EPA 160.4	Wastewater	Inorganic Analysis
Total, fixed, and volatile solids (SQAR)	SM 2540 G, 18th Ed.	Wastewater	Inorganic Analysis
Salinity	SM 2520 B-11	Wastewater	Inorganic Analysis
Silica, Dissolved	SM 4500-SiO_2 C-11	Wastewater	Inorganic Analysis
Specific Conductance	SM 2510 B-11	Wastewater	Inorganic Analysis
Specific Conductance	SW846 9050A	Wastewater	Inorganic Analysis
Sulfide (S)	SM 4500-S B,C + F-11	Wastewater	Inorganic Analysis
Sulfite (SO_3)	SM 4500-SO_3 B-11	Wastewater	Inorganic Analysis
Surfactants (Methylene Blue)	SM 5540 C-11	Wastewater	Inorganic Analysis
Temperature	SM 2550 B-00	Wastewater	Inorganic Analysis
Total Organic Carbon (TOC)	SM 5310 B-11	Wastewater	Inorganic Analysis
Total Organic Halides (TOX)	SW846 9020B	Wastewater	Inorganic Analysis
Turbidity	EPA 180.1	Wastewater	Inorganic Analysis
Metals, Total – Water	SW846 3010A	Wastewater	Metals Prep
Metals, Total – Water, Rec. + Dissolved	SW846 3005A	Wastewater	Metals Prep
Hardness, Total as $CaCO_3$	EPA 200.7	Wastewater	Metals Analysis
Hardness, Total as $CaCO_3$	SM 2340 C-11	Wastewater	Metals Analysis
Mercury	EPA 245.1	Wastewater	Metals Analysis
Metals, ICP	EPA 200.7	Wastewater	Metals Analysis
Metals, ICP/MS	EPA 200.8	Wastewater	Metals Analysis
Mercury, Low-Level	EPA 245.7	Wastewater	Metals Analysis
Mercury, Low-Level	EPA 1631E	Wastewater	Metals Analysis
Mercury, Liquid Waste	SW846 7470A	Wastewater	Metals Analysis
Separatory Funnel Extraction	SW-846 3510C	Wastewater	Semivolatile Organics
Continuous Liquid-Liquid Extraction	SW-846-3520C	Wastewater	Semivolatile Organics
Purge & Trap Aqueous	SW-846 5030B	Wastewater	Volatile Organics
Acrolein & Acrylonitrile	EPA 603	Wastewater	Organics Analysis
Base/Neutrals and Acids	EPA 625	Wastewater	Organics Analysis
Extractable Petroleum Hydrocarbons	NJDEP EPH	Wastewater	Organics Analysis
Organochlorine Pests & PCBs	EPA 608	Wastewater	Organics Analysis

Method Capabilities by NELAP Accredited Fields of Testing

Analytes	Method Number	Program	Chemistry Field
Petroleum Hydrocarbons	NJ-OQA-QAM-25	Wastewater	Organics Analysis
Volatile Organics	EPA 624	Wastewater	Organics Analysis
Semi-Volatile Organics GC/MS, Extract or Dir Inj, Capillary	SW-846 8270C SW-846 8270D	Wastewater	Semivolatile Organic Analysis
Coliform, Fecal (Count per 100 mL)	SM 9222 D-97	Wastewater	Microbiology
Coliform, Total (Count per 100 mL)	SM 9222 B-97	Wastewater	Microbiology
Heterotrophic Plate Count	SM 9215 B-00	Wastewater	Microbiology
Soluble Sulfides	SW846 9034	Solid/Haz. Waste	Inorganic Analysis
Bomb Calorimetry	ASTM D-240	Solid/Haz. Waste	Inorganic Analysis
Bromide, Chloride, Fluoride, Sulfate	SW846 9056/A	Solid/Haz. Waste	Inorganic Analysis
Cation, Exchange Capacity	SW846 9081	Solid/Haz. Waste	Inorganic Analysis
Chromium (VI) Digestion	SW846 3060A	Solid/Haz. Waste	Inorganic Analysis
Chromium (VI)	SW846 7196A	Solid/Haz. Waste	Inorganic Analysis
Chromium (VI)	SW846 7199	Solid/Haz. Waste	Inorganic Analysis
Corrosivity/pH, >20% H2O	SW846 9040C	Solid/Haz. Waste	Inorganic Analysis
Cyanide	SW846 9010C	Solid/Haz. Waste	Inorganic Analysis
Cyanide, Amenable to Chlorine	SW846 9010C	Solid/Haz. Waste	Inorganic Analysis
Cyanide	SW846 9012B	Solid/Haz. Waste	Inorganic Analysis
Extractable Organic Halides	SW846 9023	Solid/Haz. Waste	Inorganic Analysis
Free Liquid	SW846 9095	Solid/Haz. Waste	Inorganic Analysis
Ignitability	SW846 1010A	Solid/Haz. Waste	Inorganic Analysis
Oil & Grease, HEM	EPA 1664A	Solid/Haz. Waste	Inorganic Analysis
Oil & Grease and Sludge, HEM	SW846 9071B	Solid/Haz. Waste	Inorganic Analysis
pH, Hydrogen Ion	SW846 9040C	Solid/Haz. Waste	Inorganic Analysis
pH, Soil and Waste	SW846 9045D	Solid/Haz. Waste	Inorganic Analysis
Phenols (Sample Preparation)	SW846 9065	Solid/Haz. Waste	Inorganic Analysis
SPLP Metals/Organics	SW846 1312	Solid/Haz. Waste	Inorganic Analysis
TCLP Metals/Semi Volatile Organics	SW846 1311	Solid/Haz. Waste	Inorganic Analysis
TCLP Volatile Organics	SW846 1311	Solid/Haz. Waste	Inorganic Analysis
Total Organic Carbon (TOC)	SW846 9060 A	Solid/Haz. Waste	Inorganic Analysis
Metals, Solids	SW846 3050B	Solid/Haz. Waste	Metals Prep
Mercury, Solid Waste	SW846 7471A/B	Solid/Haz. Waste	Metals Analysis
Metals by ICP	SW846 6010B/C	Solid/Haz. Waste	Metals Analysis

Method Capabilities by NELAP Accredited Fields of Testing

Analytes	Method Number	Program	Chemistry Field
Metals by ICP/MS	SW846 6020/6020A	Solid/Haz. Waste	Metals Analysis
Semivolatiles, Acid/Base Partition	SW846 3650B	Solid/Haz. Waste	Organics Prep
Semivolatiles, Alumina Cleanup	SW846 3610B	Solid/Haz. Waste	Organics Prep
Semivolatiles, Alumina Cleanup (Petro)	SW846 3611B	Solid/Haz. Waste	Organics Prep
Semivolatiles, Florisil Cleanup	SW846 3620B/C	Solid/Haz. Waste	Organics Prep
Semivolatiles, Gel Permeation Cleanup	SW846 3640A	Solid/Haz. Waste	Organics Prep
Semivolatiles, Silica Gel Cleanup	SW846 3630C	Solid/Haz. Waste	Organics Prep
Semivolatiles, Sulfur Cleanup	SW846 3660B	Solid/Haz. Waste	Organics Prep
Semivolatiles, Sulfuric Acid/MnO_2	SW846 3665A	Solid/Haz. Waste	Organics Prep
Semivolatile Prep, Waste Dilution	SW846 3580A	Solid/Haz. Waste	Organics Prep
Semivolatile Prep Solid, Sonication	SW846 3550B/C	Solid/Haz. Waste	Organics Prep
Semivolatile Prep Solids, Soxhlet	SW846 3540C	Solid/Haz. Waste	Organics Prep
Semivolatile Prep Water	SW846 3520C	Solid/Haz. Waste	Organics Prep
Semivolatile Prep Water	SW846 3510C	Solid/Haz. Waste	Organics Prep
Volatile, Headspace	SW846 3810	Solid/Haz. Waste	Organics Prep
Volatile, Purge & Trap, Solids–High	SW846 5035H/5035AH	Solid/Haz. Waste	Organics Prep
Volatile, Purge & Trap, Solids–Low	SW846 5035L/5035AL	Solid/Haz. Waste	Organics Prep
Volatile, Purge & Trap, Water	SW846 5030B	Solid/Haz. Waste	Organics Prep
Microwave Extraction	SW846 3546	Solid/Haz. Waste	Organics Prep
Alcohols	SW846 8015B	Solid/Haz. Waste	Organics Analysis
Base/Neutrals and Acids	SW846 8270C/D	Solid/Haz. Waste	Organics Analysis
Chlorinated Herbicides	SW846 8151A	Solid/Haz. Waste	Organics Analysis
DBCP, EDB & TCP	SW846 8011	Solid/Haz. Waste	Organics Analysis
Diesel Range Organic	SW846 8015B/C	Solid/Haz. Waste	Organics Analysis
Dissolved Gas/Aqueous Media	RSK-175	Solid/Haz. Waste	Organics Analysis
Ethylene Glycol & Propylene Glycol	SW846 8260B	Solid/Haz. Waste	Organics Analysis
Extractable Petroleum Hydrocarbons	NJDEP EPH	Solid/Haz. Waste	Organics Analysis
Gasoline Range Organic	SW846 8015B/C	Solid/Haz. Waste	Organics Analysis
Organochlorine Pesticides	SW846 8081A/B	Solid/Haz. Waste	Organics Analysis
PCBs	SW846 8082/A	Solid/Haz. Waste	Organics Analysis
Petroleum Hydrocarbons	NJ-OQA-QAM-25	Solid/Haz. Waste	Organics Analysis
Volatile Organics	SW846 8260B/C	Solid/Haz. Waste	Organics Analysis
Volatile Organics	EPA TO- 3	Clean Air Act	Organics Analysis
Volatile Organics	EPA TO-15	Clean Air Act	Organics Analysis

Method Capabilities—Non-NELAP Methods

Analytes	Method Number	Program	Chemistry Field
Phenols	EPA 420.4	Drinking Water	Inorganic Analysis
Carbon Dioxide	SM 4500-CO_2 C or D	Wastewater	Inorganic Analysis
Iodide	SM 4500-I B	Wastewater	Inorganic Analysis
Nonionic Surfactants as CTAS	SM 5540 D	Wastewater	Inorganic Analysis
Particulate Matter	EPA 160.2M	Wastewater	Inorganic Analysis
Petroleum Hydrocarbons	EPA 418.1	Wastewater	Inorganic Analysis
Phosphorus, Hydrolyzable	EPA 365.3	Wastewater	Inorganic Analysis
Redox Potential vs H^+	ASTM D1498-76	Wastewater	Inorganic Analysis
Specific Gravity	ASTM D1298-85	Wastewater	Inorganic Analysis
Total Organic Content	ASTM D2974-87	Wastewater	Inorganic Analysis
Unburned Combustibles	EPA 160.1+160.4	Wastewater	Inorganic Analysis
Viscosity	ASTM D445/6	Wastewater	Inorganic Analysis
Volatile Suspended Solids	EPA 160.2+160.4	Wastewater	Inorganic Analysis
Weak Acid Dissociable Cyanide Prep	SM 4500-CN I	Wastewater	Inorganic Analysis
Ammonia	EPA 350.1M	Solid/Haz. Waste	Inorganic Analysis
Ammonia	EPA 350.2M	Solid/Haz. Waste	Inorganic Analysis
Base Sediment	ASTM D473-81	Solid/Haz. Waste	Inorganic Analysis
Bulk Density (Dry Basis)	ASTM D2937-94M	Solid/Haz. Waste	Inorganic Analysis
Chemical Oxygen Demand	HACH 8000M	Solid/Haz. Waste	Inorganic Analysis
Chloride	EPA 325.3M	Solid/Haz. Waste	Inorganic Analysis
Combustion, Bomb Oxidation	SW846 5050	Solid/Haz. Waste	Inorganic Analysis
Grain Size & Sieve Testing	ASTM D422-63	Solid/Haz. Waste	Inorganic Analysis
Heat Content, BTU	ASTM D3286-85	Solid/Haz. Waste	Inorganic Analysis
Ignitability (Flashpoint)	ASTM D93-90/SW846 Ch 7	Solid/Haz. Waste	Inorganic Analysis
Multiple Extractions	SW846 1320	Solid/Haz. Waste	Inorganic Analysis
Neutral Leaching Procedure	ASTM D3987-85	Solid/Haz. Waste	Inorganic Analysis
Nitrate/Nitrite	EPA 353.2M	Solid/Haz. Waste	Inorganic Analysis
Organic Matter (Ignition Loss)	AASHTO T267-86M	Solid/Haz. Waste	Inorganic Analysis
Orthophosphate	EPA 365.2M	Solid/Haz. Waste	Inorganic Analysis
Percent Ash (Dry Basis)	ASTM D482-91	Solid/Haz. Waste	Inorganic Analysis
Percent Solids	ASTM D4643-00	Solid/Haz. Waste	Inorganic Analysis
Percent Sulfur	ASTM D129-61	Solid/Haz. Waste	Inorganic Analysis
Phosphorus, Total	EPA 365.3M	Solid/Haz. Waste	Inorganic Analysis
Phosphorus, Hydrolyzable	EPA 365.3M	Solid/Haz. Waste	Inorganic Analysis

Method Capabilities—Non-NELAP Methods

Analytes	Method Number	Program	Chemistry Field
Pour Point	ASTM D97-87	Solid/Haz. Waste	Inorganic Analysis
Reactive Cyanide	SW846 7.3.3.2	Solid/Haz. Waste	Inorganic Analysis
Reactive Sulfide	SW846 7.3.4.2	Solid/Haz. Waste	Inorganic Analysis
Redox Potential vs H^+	ASTM D1498-76M	Solid/Haz. Waste	Inorganic Analysis
Specific Gravity of Solids	ASTM D1429-86M	Solid/Haz. Waste	Inorganic Analysis
Sulfide (S)	EPA 376.1 M	Solid/Haz. Waste	Inorganic Analysis
Sulfite ($SO_{3)}$	EPA 377.1M	Solid/Haz. Waste	Inorganic Analysis
Total Chlorine	ASTM D808-91	Solid/Haz. Waste	Inorganic Analysis
Total Kjeldahl Nitrogen	EPA 351.2M	Solid/Haz. Waste	Inorganic Analysis
Total Organic Carbon	CORP ENG 81	Solid/Haz. Waste	Inorganic Analysis
Total Organic Carbon	LLOYD KAHN 1988	Solid/Haz. Waste	Inorganic Analysis
Total Organic Chlorine	ASTM D808-91M	Solid/Haz. Waste	Inorganic Analysis
Total Plate Count	SM 9215BM	Solid/Haz. Waste	Inorganic Analysis
Total Volatile Solids	EPA 160.4M	Solid/Haz. Waste	Inorganic Analysis
Water Content	ASTM D95-83	Solid/Haz. Waste	Inorganic Analysis
Diesel Range Organic	TCEQ 1005	Solid/Haz. Waste	Organics Analysis
Extractable Petroleum HCs	Massachusetts EPH	Solid/Haz. Waste	Organics Analysis
Extractable Petroleum HCs	Missouri DRO	Solid/Haz. Waste	Organics Analysis
Total Petroleum Hydrocarbons	FLDEP FL-PRO	Solid/Haz. Waste	Organics Analysis
Total Petroleum Hydrocarbons	Connecticut ETPH	Solid/Haz. Waste	Organics Analysis
Volatile Petroleum HCs	Massachusetts VPH	Solid/Haz. Waste	Organics Analysis
Volatile Petroleum HCs	Missouri GRO	Solid/Haz. Waste	Organics Analysis

Appendix IV

Laboratory Equipment

Equipment	Manufacture & Description	Serial Number	Operating System Software	Data Processing Software	Location	Purchase
GC-AA	GC Agilent 7890A/FID/Entech AutoAir7000	CN10361127	HP Chemstation	HP Enviroquant	Air Laboratory	N/A
GC-II	GC HP5890/ FID	320A40375	HP Chemstation	HP Enviroquant	Air Laboratory	N/A
GCMS- 5W	Agilent Technologies 5975C / 7890A / Entech7200pre-concentrator pre-concentrator	US13207902/CN13141001/1123	HP Chemstation	HP Chemstation	Air Laboratory	2013
GCMS-2W	Agilent Technologies 5975C / 7890A Entech 7016CA	CN10361158 / US10323601 / CN10361158	HP Chemstation	HP Enviroquant	Air Laboratory	2012
GCMS-3W	Agilent Technologies 5973 / 6890N Entech 7016A	CN10425086 / US41746669 / 1351	HP Chemstation	HP Enviroquant	Air Laboratory	2007
GCMS-Q	Hewlett-Packard 5890ll / 5971 MSD / Entech Air Samp 7000	3033A31092 / 3188A02934	HP Chemstation	HP Enviroquant	Air Laboratory	1993
GCMS-W	Agilent Technologies 5973 / 6890N AS Entech 7016CA	US44621451 / CN10517032 / 1119	HP Chemstation	HP Enviroquant	Air Laboratory	2005
GC-QT	Agilent 6890 / PID / FID / Entech 7032AB-L autosampler	US10148124/1176	HP Chemstation	HP Enviroquant	Air Laboratory	2010
GC-WW	Hewlett-Packard6890 / PID	US00010037	HP Chemstation	HP Enviroquant	Air Laboratory	2010
OVEN – 10A	Entech 3100A Canister cleaner	0404-4596	None	None	Air Laboratory	N/A
OVEN – 10C	Entech 3100A Canister cleaner	0404-4597	None	None	Air Laboratory	N/A
OVEN – 10E	Entech 3100A Canister cleaner	N/A	None	None	Air Laboratory	N/A
OVEN -10F	Entech 3100A Canister cleaner	N/A	None	None	Air Laboratory	N/A
Test Gauge	Ashcroft (TG-1)	None	None	None	Air Laboratory	N/A
Test Gauge	Ashcroft (TG-2)	None	None	None	Air Laboratory	N/A
Test Gauge	Ashcroft (TG-3)	None	None	None	Air Laboratory	N/A
Test Gauge	Ashcroft (TG-4)	None	None	None	Air Laboratory	N/A
DO Meter	YSI-51B	92A035818	None	None	Field Serv.	1998
DO Meter	YSI-55/12ft	00C0598BG	None	None	Field Serv.	2000

PH Meter-10	YSI	JC02538	None	None	Field Serv.	2007
PH Meter-11	YSI	JC02540	None	None	Field Serv.	2010
PH Meter-9	Orion 250A	O18019	None	None	Field Serv.	2007
SCON Meter	YSI-30	J0183	None	None	Field Serv.	2004
Balance- Top Load	Ohaus Adventure AV212 (B-36)	8029131104	None	None	IC Lab	2008
ASE	Dionex ASE 200	99030375	None	None	Inorganics	1999
Balance-Analytical	Ohaus Adventurer (B-24)	1225032523P	None	None	Inorganics	2004
Balance-Analytical	Mettler AE 160 (B-5)	C11620	None	None	Inorganics	1999
Balance- Top Load	Ohaus Adv. Pro (B43)	8032501223	None	None	Inorganics	2012
Balance- Top Load	Denver Inst. Co. XL500 (B-14)	B045530	None	None	Inorganics	Pre-2000
Balance- Top Load	Ohaus Adv. Pro (B52)	B334691952	None	None	Inorganics	2013
Balance- Top Load	Ohaus Explorer (B-16)	E1581119212171	None	None	Inorganics	2001
Balance- Top Load	Ohaus Adventurer (B-21)	E1021218270448	None	None	Inorganics	2001
Balance- Top Load	Ohaus Adventurer AV412 (B-27)	8026251106	None	None	Inorganics	2005
Balance- Top Load	Sartorius TE31025 (B-32)	21950273	None	None	Inorganics	2007
Balance- Top Load	Ohaus Adventure AV212 (B-35)	8029171184	None	None	Inorganics	2008
Balance- Top Load	Ohaus Adventurer-Pro (B-38)	8030441010	None	None	Inorganics	2009
Balance- Top Load	Denver P-214 (B-39)	25450279	None	None	Inorganics	2010
Balance- Top Load	A+D HR-250A (B53)	687601248	None	None	Inorganics	2012
Balance- Top Load	Ohaus Adv. Pro (B37)	8029161122	None	None	Inorganics	2013

Calorimeter	PARR 1261EA	1499	None	None	Inorganics	1996
COD Block	HACH DRB200	11020C0029	None	None	Inorganics	2010
Distillation Block 1	Lachat Micro Distillation system	A2000738	None	None	Inorganics	2010
Distillation Block 12	Lachat Micro Distillation system	A2000726	None	None	Inorganics	2010
Distillation Block 3	Lachat Micro Distillation system	A2000807	None	None	Inorganics	2010
DO Meter	YSI 5000	07B1560	None	None	Inorganics	2008
FIA Analyzer	Lachat Quikchem 8000	13200001620	None	None	Inorganics	
Flashpoint	Koehler – K16200	R07002295	None	None	Inorganics	2010
Flashpoint	Koehler – K16200	R07002563B	None	None	Inorganics	2010
Hg Analyzer	HYDRAA II	64013	Envoy	Envoy	Inorganics	2011
Hg Analyzer	Leeman Mercury Analyzer HYDRAAF Gold+	9003	WIN Hg Runner	WIN Hg Runner	Inorganics	2010
Hg Analyzer 7	Hydra II	64631	Envoy	Envoy	Inorganics	2013v
IC-2	Dionex ICS2000	2090737	Dionex Chrom. Client	Dionex Chrom. Client	Inorganics	2004
IC-3	Dionex ICS2000	2110028	Dionex Chrom. Client	Dionex Chrom. Client	Inorganics	2004
IC-4	Dionex ICS2000	4060060	Dionex Chrom. Client	Dionex Chrom. Client	Inorganics	2004
IC-6	Dionex ICS3000	6040160	Dionex Chrom. Client	Dionex Chrom. Client	Inorganics	2006
IC-9	Dionex IC5000+	13120208	Dionex Chrom. Client	Dionex Chrom. Client	Inorganics	2013
IR Spec.	Buck Scientific HC-404	687	None	None	Inorganics	1997
Oven (Inc-21)	Fisher	N/A	None	None	Inorganics	2014
Oven (Inc-7)	Precision	699030922	None	None	Inorganics	2014
Oven Inc 19	Total Dissolved Solids(180°C)	20-2100149111	None	None	Inorganics	2014
PH Meter-46	Thermo Orion 4 Star	B10299	None	None	Inorganics	2008

PH Meter-47	Thermo Orion 4 Star	B04869	None	None	Inorganics	2008
PH Meter-50	Orion Star Series	B27564	None	None	Inorganics	2010
PH Meter-51	Mettler	14011	None	None	Inorganics	2013
pH Meter-53	VWR Symphony B10P	1223350009	None	None	Inorganics	2013
PH Meter-54	Thermo Orion 710A	X08035	None	None	Inorganics	2013
PH Meter-55	Thermo-Orion	X10686	None	None	Inorganics	2014
pH Meter-57	VWR Symphony B10P	1411150002	None	None	Inorganics	2014
pH Meter-59	VWR Symphony B10P	14087S0006	None	None	Inorganics	2014
PH Meter-60	VWR Symphony B10P	1413950006	None	None	Inorganics	2014
PH-EH Meter-22	Thermo Orion 4 Star	SN00742	None	None	Inorganics	2008
SCON Meter	Amber Science 1056	01020851056-101	None	None	Inorganics	2001
SCON Meter	Orion 145+	78035	None	None	Inorganics	2004
Solvent Evaporator	Horizon SPE-DEX 3000XL	09-1031	None	None	Inorganics	2010
Solvent Evaporator	Horizon SPEED VAP III	09-0739	None	None	Inorganics	2010
TCLP Rotator 4	Assoc. Design and Mfg. Co. 3740-24-BRE-TM	N/A	None	None	Inorganics	2000
TCLP Rotator 5	Analytical Testing Corp. 42R5BCI-E3	0685KZJP0013	None	None	Inorganics	2002
TCLP Rotator 7&8	Assoc. Design and Mfg. Co. 3740-48BRE	N/A	None	None	Inorganics	2000
TCLP Rotator 9&10	Assoc. Design and Mfg. Co. 3740-48BRE	2132337	None	None	Inorganics	1996
TOC-L Analyzer	Shimadzu TOC-L	H52516900071	Shimadzu TOC Control	Shamadzu TOC Control	Inorganics	2012
TOC-L Analyzer	Shimadzu TOC-L	H52515000114NK	Shimadzu TOC Control	Shamadzu TOC Control	Inorganics	2013
TOC-V Analyzer	Shimadzu TOC-V CSH	H52504400192NK	Shimadzu TOC Control	Shimadzu TOC Control	Inorganics	2007
TOX Analyzer	Mitsubishi TOX-100	N/A	None	None	Inorganics	1996

TOX Analyzer	Mitsubishi TOX-100	A7M 42997	None	None	Inorganics	2008
UVVIS Spec E	Spectronix 20 Genesys	3SGD.352011	None	None	Inorganics	2007
UVVIS Spec J	Thermo Electron Corp. Genesys 20	3SGQ235018	None	None	Inorganics	20012
UVVIS Spec L	Thermo Electron Corp. Genesys 20	3SGS073003	None	None	Inorganics	2014
UVVIS Spec M	Spectronix 20 Genesys	3SG82480005	None	None	Inorganics	2013
UVVIS Spec N	Spectronix 20 Genesys	3SGS247010	None	None	Inorganics	2013
IC-8	Dionex IC5000	11030895	Dionex Chrom. Client	Dionex Chrom Client	Inorganics	
PH Meter-23	Thermo Orion Model 310	SN013786	None	None	Inorganics	2008
Hot Block 8	Environmental Express	N/A	None	None	Mercury Prep	
Hot Block 7	Environmental Express	N/A	None	None	Mercury Prep	
ICP	Thermo ICP 6500 Duo	ICP-20074909	ITEVA	ITEVA	Metals	2007
ICP	Thermo ICP 6500 Duo	ICP-20114506	ITEVA	ITEVA	Metals	2011
ICP	Thermo ICP 6500 Duo	ICP-20072601	ITEVA	ITEVA	Metals Analysis	2007
ICP	Thermo ICP 6500 Duo	IC5D20122506	ITEVA	ITEVA	Metals Analysis	2012
ICP	Thermo ICP 6500 Duo	IC76DC134708	ITEVA/QTEG RA	ITEVA/QTEGR A	Metals Analysis	2014
ICP-MS	Agilent 7700 Series	JP12412081	MassHunter Workstation	MassHunter Workstation	Metals Analysis	2014
ICP-MS	Agilent 7700 Series	JP10340551	MassHunter Workstation	MassHunter Workstation	Metals Analysis	2010
Balance- Top Load	Ohaus Adventurer AR3130 (B-26)	1240-P	None	None	Metals Prep	2004
Hot Block 1	Environmental Express	N/A	None	None	Metals Prep	
Hot Block 2	Environmental Express	N/A	None	None	Metals Prep	
Hot Block 3	Environmental Express	N/A	None	None	Metals Prep	
Hot Block 4	Environmental Express	N/A	None	None	Metals Prep	
Hot Block 5	Environmental Express	N/A	None	None	Metals Prep	
Hot Block 6	Environmental Express	N/A	None	None	Metals Prep	

Balance- Top Load	Ohaus Scout II (B-20)	BJ320905	None	None	Methanol Prep	2002
Balance- Top Load	Ohaus Scout II (B-25)	BJ514770	None	None	Methanol Prep	2004
Autoclave	Tuttnauer	1308435	None	None	Microbiology	2011
Incubator (BOD)	VWR	702499	None	None	Microbiology	2011
Incubator (Plates)	Theclo Precision	11T3	None	None	Microbiology	N/A
Incubator(BOD)	ISOTEMP	317646	None	None	Microbiology	2010
Incubator-Water Bath	INC-2	1200991	None	None	Microbiology	N/A
Refrigerator	R-44	0503MCBR980W0087	None	None	Microbiology	N/A
Incubator (Plates)	Thelco Precision	4-D-5	None	None	Microbiology	N/A
Balance- Top Load	Ohaus Adventurer Pro (B-46)	B304755401	None	None	Organic Prep	Pre-2000
Balance- Top Load	Ohaus Adventurer Pro (B-45)	B033051054	None	None	Organic Prep	2002
Balance- Top Load	Ohaus Adventurer Pro (B-42)	B031331113	None	None	Organic Prep	2007
Balance- Top Load	Ohaus Adventurer Pro (B-47)	4755411	None	None	Organic Prep	2013
Buchi -1	Buchi Concentrator System	1000175446	None	None	Organic Prep	2014
Buchi -2	Buchi Concentrator System	1000175108	None	None	Organic Prep	2014
Buchi-3	Buchi Concentrator System	1000175657	None	None	Organic Prep	2014
Buchi-4	Buchi Concentrator System	Not in service	None	None	Organic Prep	N/A
Centrifuge	Thermo Scientific	41394883	None	None	Organic Prep	2014
GPC4	Waters 717	717-000152	None	None	Organic Prep	1992
Microwave-3	MARS 6 CEM	MJ2659 (warranty expires June 2014)	None	None	Organic Prep	2013
Microwave-4	MARS 6 CEM	MJ2198	None	None	Organic Prep	2013
Microwave-5	MARS 6 CEM	MJ2197	None	None	Organic Prep	2013
Mini Water Bath	Thermo Scientific	234221-1379	None	None	Organic prep	2014
N-EVAP 1	Organomation	59301	None	None	Organic Prep	2014
N-EVAP 2	Organomation	58202	None	None	Organic Prep	2014

Sonicator	Fisher	F550	None	None	Organic Prep	N/A
Sonicator	Bransen	BIO3037527	None	None	Organic Prep	N/A
Sonicator	Misonix	S3000	None	None	Organic Prep	1997
Water Bath 1	Organomation	13385	None	None	Organic Prep	2010
Water Bath 10	Organomation	58394	None	None	Organic prep	2014
Water Bath 11	Organomation	58384	None	None	Organic prep	2014
Water Bath 2	Thermo Scientific	176676-1289	None	None	Organic Prep	2014
Water Bath 3	Organomation	58471	None	None	Organic Prep	2010
Water Bath 4	Organomation	58421	None	None	Organic Prep	2014
Water Bath 5	Organomation	58422	None	None	Organic Prep	2014
Water Bath 8	Organomation	58424	None	None	Organic Prep	2014
Water Bath 9	Organomation	58425	None	None	Organic prep	2013
Water Bath 6	Organomation	58423	None	None	Organic Prep	2014
Water Bath 7	Organomation	58379	None	None	Organic Prep	2014
GC-SN	Hewlett Packard 5890 GC/5970 MSD/OI 4551/4560	2623A08318/2637A01687/D538475262/1542 461919	HP Chemstation	Hp Enviroquant	Organics,	Re-Built 2012
GC-SC	Hewlett-Packard 5890 / FID / OI4551 / 4560	2443AO3797	HP Chemstation	HP Enviroquant	Organics; Screening	1990
GC-SR	Hewlett-Packard 5890 / FID / Tekmar 7000	2612A07448	HP Chemstation	HP Enviroquant	Organics; Screening	1992
GC-ST	Hewlett-Packard 5890 / FID / NPD / HP 7673 AS / Tek	314OA38871	HP Chemstation	HP Enviroquant	Organics; Screening	1996
GC-SV	Hewlett-Packard 5890 / FID / OI4551 / 4560	LR47-359C / N244460743 / 3336A58859	HP Chemstation	HP Enviroquant	Organics; Screening	1996
GC 7y/7z	Agilent Technologies 6890N / 7683	US00043006 / US12211759 / CN52926441 / CN60931595	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GC-5G	Agilent Technologies 7890N/7693	CN12131022 / CN12060027 / CN12070097 / U20782/U20781	HP Chemstation	HP Enviroquant	Organics; SVOCs	2008
GC-5y-5z	Agilent Technologies 7890N / 7683	CN11461115 / CN11380009 / CN11390012 / CN73342671	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GC-6G	Agilent Technologies 6890N 7683	CN10611064 / CN44330971 / CN40334835 / U4788 / U18013	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GC-6y-6z	Agilent Technologies 7890N / 7683	CN11461118 / CN10310044 / CN83252932 / CN73342695	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010

GC-7G	Agilent Technologies 6890N 7683	US10606009 / CN53236207 / CN40434847 / U23574/ U24374	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GC-8y/8z	Agilent Technologies 6890N / 7683	US10240121 / GT030513A / CN43038210 / CN40334821	HP Chemstation	HP Enviroquant	Organics; SVOCs	2011
GCMS-4P	Agilent Technologies 5973 / 6890N AS 7683 AS	CN10251017 / US102440773 / CN34727122 / CN61031719	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GCMS-5P	Agilent Technologies 5973 / 6890N AS 7683 AS	CN10222060 / US21844818 / CN52834726 / CN21725012	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GC-XX	Hewlett-Packard 6890 / Dual ECD / HP 7683 AS	US00022968 / CN32023953 / CN32030876 / U0109 / U0905	HP Chemstation	HP Enviroquant	Organics; SVOCs	1998
GC-UV	Hewlett-Packard 5890 / Dual FID / OI 4551 / 4560	2921A23322	HP Chemstation	HP Enviroquant	Organics; Volatiles	1996
GC-2Y/2Z	Agilent Technologies 6890N 7683	CN10407032 / CN61633946 / US94209706 / US01112207	HP Chemstation	HP Enviroquant	Organics; SVOCs	2004
GC-OA	Agilent Technologies 6890N / 7683	US10240147 / CN23021337 / CN320308791 / U5591 / U7670	HP Chemstation	HP Enviroquant	Organics; SVOCs	2002
GC-YZ/ZZ	Hewlett-Packard 6890 / 6890	US00011065 / 3527A39121 / 3521A42714 / 3511A42110	HP Chemstation	HP Enviroquant	Organics; SVOCs	2008
GC-EF	Hewlett-Packard 5890 / Dual ECD / HP 7673 AS	2541A06786 / 2942A20889 /F1916 / F5562	HP Chemstation	HP Enviroquant	Organics; Volatiles	1992
GC-LM	Hewlett-Packard 6890 / PID / FID / OI 4551 / 4560 P&T	US00008927	HP Chemstation	HP Enviroquant	Organics; Volatiles	1998
GCMS-L	Hewlett-Packard 5890 / 5970 MSD / OI 4551 / 4560 P&T	2921A22898 / 2623A01291	HP Chemstation	HP Enviroquant	Organics; Volatiles	1992
GC-SY	Hewlett-Packard 5890 / FID / OI4551A / 4560	2643A10503	HP Chemstation	HP Enviroquant	Organics; Screening	1990
GC-1G	Agilent Technologies 6890N / 7683	US10322012 / CN23821917 / CN23326744 / U21778 / U5597	HP Chemstation	HP Enviroquant	Organics; SVOCs	2003
GC-2G	Agilent Technologies 6890N / 7683	CN10450110 / CN24922557 / CN45022276 / U17684 / U7668	HP Chemstation	HP Enviroquant	Organics; SVOCs	2005
GC-3G	Agilent Technologies 6890N / 7683	CN10450109 / CN24922566 / CN45022167 / U7666 / U7667	HP Chemstation	HP Enviroquant	Organics; SVOCs	2005
GC-3Y/3Z	Agilent Technologies 7890A / 7683B	CN10735014 / CN74345941 / CN83252932 / CN73342695	HP Chemstation	HP Enviroquant	Organics; SVOCs	2007
GC-4G	Agilent Technologies 6890N / 7693	CN10361136 / CN10340093 / CN10310033 / U17615 / U17614	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GC-4Y/4Z	Agilent Technologies 7890A / 7693B	CN10832133 / CN84451068 / CN83252936 / CN73342671	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GCMS-2M	Agilent Technologies 5975 / 6890N AS 7683	CN10612028 / US60532578 / CN4593809290 / US82601187	HP Chemstation	HP Enviroquant	Organics; SVOCs	2012

GCMS-2P	Agilent Technologies 5975C / 7890A / 7693	US10237403 / CN10241022 / CN10210021 / CN10180007	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GCMS-3E	Agilent Technologies 5975 / 6890N / 7683	CN10614011 / US61332852 / CN23326747 / US93901916	HP Chemstation	HP Enviroquant	Organics; SVOCs	2011
GCMS-3M	Agilent Technologies 5975B / 6890N / Agilent 7683B	US65125107 / CN10703029 / CN73943902 / US83801832	HP Chemstation	HP Enviroquant	Organics; SVOCs	2007
GCMS-3P	Agilent Technologies 5975C / 7890A / 7693	CN10361100 / CN10361163 /	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GCMS-4M	Agilent Technologies 5975C / 7890A / 7683B	US73317574 / CN1074251 / CN74043923 / CN74145736	HP Chemstation	HP Enviroquant	Organics; SVOCs	2007
GCMS-4P	Agilent Technologies 5973 / 6890N AS 7683 AS	CN10251017 / US102440773 / CN34727122 / CN61031719	HP Chemstation	HP Enviroquant	Organics; SVOCs	2011
GCMS-6P	Agilent Technologies 5973 / 6890N AS 7683 AS	CN10536029 / US52420712 / US10310521 / CN55230259	HP Chemstation	HP Enviroquant	Organics; SVOCs	2011
GCMS-F	Agilent 6890 / 5973 MSD / 7683 AS	US00034179 / US01140200 / CN40327643 / CN138822139	HP Chemstation	HP Enviroquant	Organics; SVOCs	1998
GCMS-H	Hewlett-Packard 5890ll+ / 5972 MSD / HP 7673 AS	3336A58190 / 3501A02356 / 3123A25133	HP Chemstation	HP Enviroquant	Organics; SVOCs	1995
GCMS-M	Hewlett-Packard 6890 / 5973 MSD / HP 7683 AS	US00021813 / US802111003 / US81501001 / CN61038860	HP Chemstation	HP Enviroquant	Organics; SVOCs	1999
GCMS-P	Agilent Technologies 5973 / 6890N AS 7683 AS	US10251064 / US21844598 / CN74145733 / CN24828486	HP Chemstation	HP Enviroquant	Organics; SVOCs	2003
GCMS-R	Agilent Technologies 6890 / 5973 MSD / 7683	US00021820 / US81211033 / US84202752 / CN61639349	HP Chemstation	HP Enviroquant	Organics; SVOCs	2008
GCMS-Z	Agilent Technologies 5973 / 6890N AS 7683 AS	US10251028 / US21844586 / CN24828485 / CN23321564	HP Chemstation	HP Enviroquant	Organics; SVOCs	2003
Balance- Top Load	Ohaus Sport (B-28)	7124230518	None	None	Organics; Volatiles	2005
Balance- Top Load	Ohaus Adventure AV412 (B-34)	8028391117	None	None	Organics; Volatiles	2007
GC-AA	Agilent 7890A / AS 7683B	CN10832133 / US08232002	HP Chemstation	HP Enviroquant	Organics; Volatiles	2008
GC-GH	Hewlett-Packard 5890	2938A25059	HP Chemstation	HP Enviroquant	Organics; Volatiles	1990
GCMS-1A	Agilent Technologies 5973 / 6890N AS 4551A / 4660	CN10314026 / US30945331	HP Chemstation	HP Enviroquant	Organics; Volatiles	2003
GCMS-1B	Agilent Technologies 7890A / 5975C /Teledyne / Tekmar AquaTek AS	CN10845177 / US83111119	HP Chemstation	HP Enviroquant	Organics; Volatiles	2008
GCMS-1C	Agilent Technologies 5973 /	CN10425085 / US41746667	HP Chemstation	HP Enviroquant	Organics;	2004

	6890N AS 4551 / 4560				Volatiles	
GCMS-2A	Agilent Technologies 5973 / 6890N AS Tekmar Solatek 72	CN10314028 / US30945325	HP Chemstation	HP Enviroquant	Organics; Volatiles	2003
GCMS-2B	Agilent Technologies 5973 / 6890N AS 4551A / 4660	CN10441033 / US 43146954	HP Chemstation	HP Enviroquant	Organics; Volatiles	2004
GCMS-2C	Agilent Technologies 5973 / 6890N AS 4551A / 4560	CN10441035 / US 43146953	HP Chemstation	HP Enviroquant	Organics; Volatiles	2004
GCMS-2D	Agilent Technologies 5973 / 6890N AS 4552 / 4560	CN10432038 / US43146771	HP Chemstation	HP Enviroquant	Organics; Volatiles	2004
GCMS-2E	Agilent Technologies 5975 / 6890N AS 4551A / 4660	CN10612046 / US60532596	HP Chemstation	HP Enviroquant	Organics; Volatiles	2006
GCMS-3A	Agilent Technologies 5973 / 6890N AS 4551A / 4660	CN10432042 / US43146776	HP Chemstation	HP Enviroquant	Organics; Volatiles	2004
GCMS-3B	Agilent Technologies 6890 / 5973 / OI 4551A / 4660	US10240044 / US21844015	HP Chemstation	HP Enviroquant	Organics; Volatiles	2002
GCMS-3C	Agilent Technologies 5973 / 6890N AS 45551A / 4660	CN10517038 / US44621480	HP Chemstation	HP Enviroquant	Organics; Volatiles	2005
GCMS-3D	Agilent Technologies 5975B / 6890N AS 4551A / 4660	CN10637120 / US62724193	HP Chemstation	HP Enviroquant	Organics; Volatiles	2006
GCMS-3V	Agilent Technologies 5975C/7890A/OI 4552/ 4560	US1321790 / CN13141045	HP Chemstation	HP Enviroquant	Organics; Volatiles	2013
GCMS-4B	Agilent Technologies 5975C / 7890A	US10323601 / CN10361158	HP Chemstation	HP Enviroquant	Organics; Volatiles	2010
GCMS-4D	Agilent Technologies 5975C / 7890A	US10237301 / CN10241019	HP Chemstation	HP Enviroquant	Organics; Volatiles	2010
GCMS-4V	Agilent Technologies 5975C/7890A/OI 4100/ 4660	Us13307901 / CN13331029	HP Chemstation	HP Enviroquant	Organics; Volatiles	2013
GCMS-A	Hewlett-Packard 6890 / 5973 MSD / OI 4552 / 4560 ARCHON	US00033272 / US94212183	HP Chemstation	HP Enviroquant	Organics; Volatiles	2000
GCMS-C	Hewlett-Packard 6890 / 5973 MSD / OI 4552 / 4560 ARCHON	2643A122671 / 2807A1146	HP Chemstation	HP Enviroquant	Organics; Volatiles	1990
GCMS-D	Hewlett-Packard 6890 / 5973 MSD / OI 4551 / 4560 ARCHON	US00030551 / US93122843	HP Chemstation	HP Enviroquant	Organics; Volatiles	2001
GCMS-E	Hewlett-Packard 6890 / 5973 MSD / OI 4551 / 4560 ARCHON	US00031161 / US93112044	HP Chemstation	HP Enviroquant	Organics; Volatiles	2001

GCMS-G	Hewlett-Packard 5890ll / 5970 MSD / OI 4552 / 4660	2919A22540 / 2807A11004	HP Chemstation	HP Enviroquant	Organics; Volatiles	1989
GCMS-I	Hewlett-Packard 5890 / 5970 MSD / OI 4551 / 4560	2623A08318 / 2637A01687	HP Chemstation	HP Enviroquant	Organics; Volatiles	1986
GCMS-J	Hewlett-Packard 5890 / 5970 MSD / OI 4552 / 4560 P&T	2643A11557 / 3034A12779	HP Chemstation	HP Enviroquant	Organics; Volatiles	1990
GCMS-K	Hewlett-Packard 5890l1 / 5970 MSD / OI 4551 / 4560 P&T	2750A116838 / 2905A11628	HP Chemstation	HP Enviroquant	Organics; Volatiles	1990
GCMS-N	Hewlett-Packard 5890 / 5970 MSD / Tekmar 2000 / 2032 P&T	2750A17088 / 2716A10218	HP Chemstation	HP Enviroquant	Organics; Volatiles	1988
GCMS-S	Hewlett-Packard 6890 / 5973 MSD /OI 4552 / 4660 ARCHON	US00024322 / US82311313	HP Chemstation	HP Enviroquant	Organics; Volatiles	2000
GCMS-T	Hewlett-Packard 6890 / 5973 MSD / OI 4551A / 4660 P&T	US00024323 / US82311482	HP Chemstation	HP Enviroquant	Organics; Volatiles	2000
GCMS-U	Hewlett-Packard 6890 / 5973 MSD / HP 4551A / 4660	US00032623 / US94212203	HP Chemstation	HP Enviroquant	Organics; Volatiles	1999
GCMS-V	Agilent Technologies 5973 / 6890N AS 4552 / 4560	US10149085 / US10441917	HP Chemstation	HP Enviroquant	Organics; Volatiles	2002
GCMS-X	Agilent Technologies 5973 / 6890N AS 4552 / 4660	US21843889 / US10239071	HP Chemstation	HP Enviroquant	Organics; Volatiles	2002
GCMS-Y	Agilent Technologies 5973 / 6890N AS 4552 / 4560	US10240013 / US21844012	HP Chemstation	HP Enviroquant	Organics; Volatiles	2002
GC-PF	Agilent Technologies 6890N AS 4552 / 4560	US10235024 / 12995 / J542460192	HP Chemstation	HP Enviroquant	Organics; Volatiles	2002
PH Meter-13	VWR IS B20	5942	None	None	Sample Management	2010
Balance- Top Load	Ohaus Adventure AV412 (B-33)	8028391184	None	None	Sample Management	2007
Balance- Top Load	Ohaus Adventurer AV412 (B-30)	8026391160	None	None	Screen	2005

Quality Systems Manual

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Document Control Number: 16

Nancy Cole

Nancy Cole, Laboratory Director
Technical Director-Inorganics

Nicholas C Straccione,
Quality Assurance Manager

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732.329.0200

Introduction

The SGS Accutest Inc. Quality Assurance System, detailed in this plan, has been designed to meet the quality program requirements of the National Environmental Laboratory Accreditation Program (NELAP), ISO Guide 17025, the Department of Defense Environmental Laboratory Approval Program (DOD ELAP) and other National environmental monitoring programs. The plan establishes the framework for documenting the requirements of the quality processes regularly practiced by the Laboratory. The Quality Assurance Director is responsible for changes to the Quality Assurance Program, which is appended to the Quality System Manual (QSM) during the annual program review. The plan is also reviewed annually for compliance purposes by the Company President and Laboratory Director and edited if necessary. Changes that are incorporated into the plan are itemized in a summary of changes following the introduction. Plan changes are communicated to the general staff in a meeting conducted by the Director of Quality Assurance following the plan's approval.

The SGS Accutest Inc. plan is supported by standard operating procedures (SOPs), which provide specific operational instructions on the execution of each quality element and assure that compliance with the requirements of the plan are achieved. SGS Accutest Inc. employees are responsible for knowing the requirements of the SOPs and applying them in the daily execution of their duties. These documents are updated as changes occur and the staff is trained to apply the changes.

At SGS Accutest Inc., we believe that satisfying client requirements and providing a product that meets or exceeds the standards of the industry is the key to a good business relationship. However, client satisfaction cannot be guaranteed unless there is a system that assures the product consistently meets its design requirements and is adequately documented to assure that all procedural steps are executed, properly documented and traceable.

This plan has been designed to assure that this goal is consistently achieved and the SGS Accutest Inc. product withstands the rigors of scrutiny that are routinely applied to analytical data and the processes that support its generation.

Summary of Changes
SGS Accutest Inc. Quality System Manual – January 2016

Section	Page	Description
2.3	7	Chain of Command - Heather Hall _QA Director
3.0	9	QA organizational chart, Heather Hall _QA Director
8.12	34	Added performance limits from section 12.7
12.7	53	Removed, transferred to section 8.12
Appendix I		
Appendix III Methods		

Table of Contents

1.0 QUALITY POLICY

1.1 ***SGS Accutest Inc. Mission***:

SGS Accutest Inc. provides analytical services to commercial and government clients in support of environmental monitoring and remedial activities as requested. The Laboratory's mission is dedicated to providing reliable data that satisfies client's requirements as explained in the following:

"Provide easy access, high quality, analytical support to commercial and government clients which meets or exceeds data quality objectives and provides them with the data needed to satisfy regulatory requirements and/or make confident decisions on the effectiveness of remedial activities."

These services are provided impartially and are not influenced by undue commercial or financial pressures which might impact the staff's technical judgment. Coincidently, SGS Accutest Inc. does not engage in activities that endanger the trust in our independent judgment and integrity in relation to the testing activities performed.

1.2 ***Policy Statement***:

The management and staff of SGS Accutest Inc. share the responsibility for product quality and the commitment to the continual improvement of the quality system. Accordingly, SGS Accutest Inc.'s quality assurance program is designed to assure that all processes and procedures, which are components of environmental data production, meet established industry requirements, are adequately documented from a procedural and data traceability perspective, and are consistently executed by the staff. It also assures that analytical data of known quality, meeting the quality objectives of the analytical method in use and the data user's requirements, is consistently produced in the laboratory. This assurance enables the data user to make rational, confident, cost-effective decisions on the assessment and resolution of environmental issues.

The laboratory Quality System also provides the management staff with data quality and operational feedback information. This enables them to determine if the laboratory is achieving the established quality and operational standards, which are dictated by the client or established by regulation. The information provided to management, through the QA program, is used to assess operational performance from a quality perspective and to perform corrective action as necessary.

All employees of SGS Accutest Inc. participating in environmental testing receive quality system training and are responsible for knowing and complying with the system requirements. The entire staff shares SGS Accutest Inc.'s commitment to good professional practice.

01/19/2016

President & Chief Executive Officer — Date

2.0 ORGANIZATION

2.1 ***Organizational Entity***. SGS Accutest Inc. is a privately held, independent testing laboratory founded in 1956 and registered as a New Jersey Corporation. The headquarters are located in Dayton, New Jersey where it has conducted business since 1987. Satellite laboratories are maintained in Marlborough, Massachusetts; Orlando, Florida, Houston, Texas, San Jose, California, Wheat Ridge, Colorado, and Scott Louisiana.

2.2 *Management Responsibilities*

Requirement: Each laboratory facility has an established chain of command. The duties and responsibilities of the management staff are linked to the Board of Directors/CEO of SGS Accutest Inc. who establishes the agenda for all company activities.

President/CEO. Primary responsibility for all operations and business activities. Delegates authority to laboratory directors, general managers, and the quality assurance director to conduct day to day operations and execute quality assurance duties. Each of the seven operational entities (New Jersey, Florida, Massachusetts, Texas, California, Colorado, and Louisiana) report to the President/CEO.

Laboratory Director. Executes day to day responsibility for laboratory operations including technical aspects of production activities and associated logistical procedures. Reports directly to the President/CEO.

Quality Assurance Director. Design, oversight, and facilitation responsibility for all Quality System elements identified in the Quality Program. Reports directly to the President/CEO.

Technical Directors (Organics/Inorganic). Responsible for day to day operations and activities of the organics and inorganics laboratories including scheduling, production and data quality. Reports directly to the Laboratory Director.

Organics Manager. Responsible for laboratory managers, supervisors and analyst performing daily laboratory procedures in semi-volatiles and organic prep.

Department Managers. Executes day to day responsibility for specific laboratory areas including technical aspects of production activities and associated logistical procedures. Directly report to the laboratory director.

Section Supervisors. Executes day to day responsibility for specific laboratory units including technical aspects of production activities and associated logistical procedures. Direct report to the Department Manager.

2.3 ***Chain of Command***

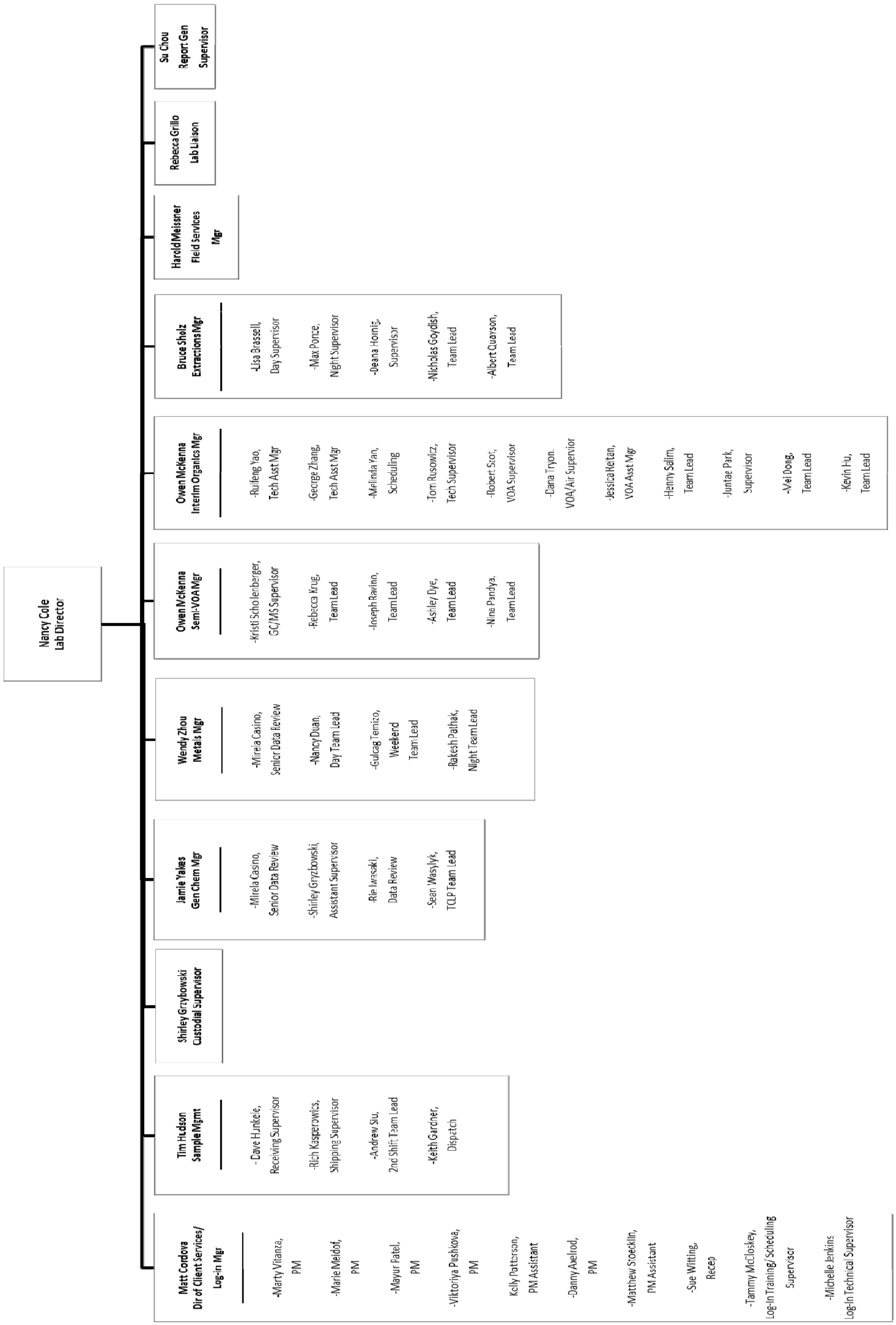
The responsibility for managing all aspects of the Company's operation is delegated to specific individuals, who have been assigned the authority to act in the absence of the senior staff. These individuals are identified in the following Chain of Command:

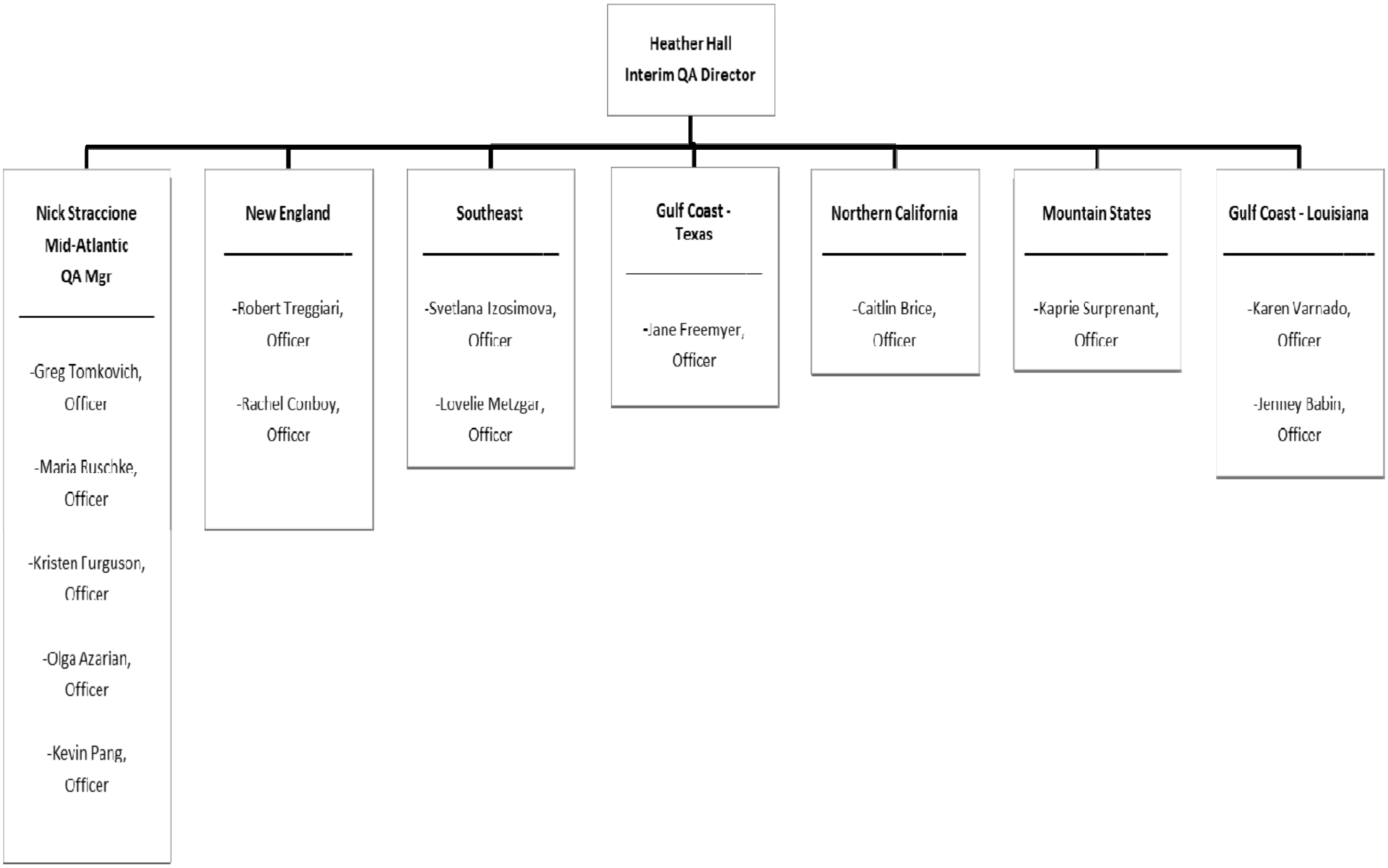
Karl Schoene, President & Chief Executive Officer SGS Accutest Inc.
Chad Tate, Chief Financial Officer
Nancy Cole, Laboratory Director
Heather Hall, Director, Corporate Quality Assurance
Matt Cordova, Director, Client Services

2.4 ***Organization Chart***

The hierarchy of the Company's operational control and oversight is illustrated in the SGS Accutest Inc. Organization Chart. Employees listed with an asterisk would be considered to be the appointed deputy in the event that the technical director or corporate quality assurance director are absent from their respective position for a period of time exceeding fifteen (15) consecutive calendar days. If this absence exceeds thirty-five (35) consecutive calendar days the laboratory shall notify the NJDEP-Office of Quality Assurance in writing.

Should this absence exceed sixty-five consecutive calendar days the DOD ELAP Accrediting Body shall be notified in writing.


Nancy Cole
Lab Director
Matt Cordova
Dir of Client Services/
Log-in Mgr
-Marty Vitanza, PM
-Marie Meldof, PM
-Mayur Patel, PM
-Viktoriya Pushkova, PM
Kelly Patterson, PM Assistant
-Danny Axelrod, PM
-Matthew Stoecklin, PM Assistant
-Sue Witting, Recep
-Tammy McCloskey, Log-In Training/ Scheduling Supervisor
-Michelle Jenkins Log-In Technical Supervisor
Tim Hudson
Sample Mgmt
- Dave Hunkele, Receiving Supervisor
-Rich Kasperowics, Shipping Supervisor
-Andrew Siu, 2nd Shift Team Lead
-Keith Gardner, Dispatch
Shirley Grzybowski
Custodial Supervisor
Jamie Yakes
Gen Chem Mgr
-Mirela Casino, Senior Data Review
-Shirley Gryzbowski, Assistant Supervisor
-Rie Iwasaki, Data Review
-Sean Wasylyk, TCLP Team Lead
Wendy Zhou
Metals Mgr
-Mirela Casino, Senior Data Review
-Nancy Duan, Day Team Lead
-Gulcag Temizo, Weekend Team Lead
-Rakesh Pathak, Night Team Lead
Owen McKenna
Semi-VOA Mgr
-Kristi Scholenberger, GC/MS Supervisor
-Rebecca Krug, Team Lead
-Joseph Ravino, Team Lead
-Ashley Dye, Team Lead
-Nina Pandya, Team Lead
Owen McKenna
Interim Organics Mgr
-Ruifeng Yao, Tech Asst Mgr
-George Zhang, Tech Asst Mgr
-Melinda Yan, Scheduling
-Tom Rusowicz, Tech Supervisor
-Robert Szot, VOA Supervisor
-Dana Tryon. VOA/Air Supervior
-Jessica Keitan, VOA Asst Mgr
-Henny Salim, Team Lead
-Juntae Park, Supervisor
-Mei Dong, Team Lead
-Kevin Hu, Team Lead
Bruce Sholz
Extractions Mgr
-Lisa Brassell, Day Supervisor
-Max Ponce, Night Supervisor
-Deana Hornig, Supervisor
-Nicholas Goydish, Team Lead
-Albert Quayson, Team Lead
Harold Meissner
Field Services
Mgr
Rebecca Grillo
Lab Liaison
Su Chou
Report Gen
Supervisor


Heather Hall
Interim QA Director
Nick Straccione
Mid-Atlantic
QA Mgr
-Greg Tomkovich, Officer
-Maria Ruschke, Officer
-Kristen Furguson, Officer
-Olga Azarian, Officer
-Kevin Pang, Officer
New England
-Robert Treggiari, Officer
-Rachel Conboy, Officer
Southeast
-Svetlana Izosimova, Officer
-Lovelie Metzgar, Officer
Gulf Coast - Texas
-Jane Freemyer, Officer
Northern California
-Caitlin Brice, Officer
Mountain States
-Kaprie Surprenant, Officer
Gulf Coast - Louisiana
-Karen Varnado, Officer
-Jenney Babin, Officer

3.0 QUALITY RESPONSIBILITIES OF THE MANAGEMENT TEAM

3.1 ***Requirement***: Each member of the management team has a defined responsibility for the Quality System. System implementation and operation is designated as an operational management responsibility. System design and implementation is designated as a Quality Assurance Responsibility.

President/CEO. Primarily responsible for process improvements to all business aspects of the company.

Laboratory Director. Responsible for implementing and operating the Quality System in all laboratory areas. Responsible for the design and implementation of corrective action for defective processes. Has the authority to delegate Quality System implementation responsibilities.

Quality Assurance Director. Responsible for design, implementation support, training, and monitoring of the quality system. Identifies product, process, or operational defects using statistical monitoring tools and processes audits for elimination via corrective action. Empowered with the authority to halt production if quality issues warrant immediate action. Monitors implemented corrective actions for compliance.

Technical Directors. Responsible for overseeing the technical aspects of the quality assurance system as they are integrated into method applications and employed to assess analytical control on a daily basis. The Technical directors review and acknowledge the technical feasibility of proposed QA systems involving technical applications of applied methodology.

Department Managers. Responsible for applying the requirements of the Quality System in their section and assuring subordinate supervisors and staff apply all system requirements. Initiates, designs, documents, and implements corrective action for quality deficiencies.

Section Supervisors & Team Leaders. Responsible for applying the requirements of the Quality System to their operation and assuring the staff applies all system requirements. Initiates, designs, documents, and implements corrective action for quality deficiencies.

Quality Assurance Officers. Responsible for design support, implementation support, training, and monitoring support for the quality system. Conducts audits and product reviews to identify product, process, or operational defects using statistical monitoring tools and processes audits for elimination via corrective action. Provides support for implemented corrective actions for compliance. Serves as the primary alternate in the absence of the Quality Assurance Director.

Bench Analysts. Responsible for applying the requirements of the Quality System to the analyses they perform, evaluating QC data and initiating corrective action for quality control deficiencies within their control. Implements global corrective action as directed by superiors.

3.2 ***Program Authority***. Authority for program implementation originates with the Board of Directors who bears the ultimate responsibility for system design, implementation, and enforcement of requirements. This authority and responsibility is delegated to the Director of Quality Assurance who performs quality functions independently without the encumbrances or biases associated with operational or production responsibilities to ensure an honest, independent assessment of quality issues.

3.3 ***Data Integrity Policy***: The SGS Accutest Inc. Data Integrity Policy reflects a comprehensive, systematic approach for assuring that data produced by the laboratory accurately reflects the outcome of the tests performed on field samples and has been produced in a bias free environment by ethical professionals. The policy includes a commitment to technical ethics, staff training in ethics and data integrity, an individual attestation to data integrity and procedures for evaluating data integrity. Senior management assumes the responsibility for assuring compliance with all technical ethics elements and operation of all data integrity procedures. The staff is responsible for compliance with the ethical code of conduct and for practicing data integrity procedures.

The SGS Accutest Inc. Data Integrity Policy is as follows:

"SGS Accutest Inc. is committed to producing data that meets the data integrity requirements of the environmental regulatory community. This commitment is demonstrated through the application of a comprehensive data integrity program that includes ethics and data integrity training, data integrity evaluation procedures, staff participation and management oversight. Adherence to the specifications of the program assures that data provided to our clients is of the highest possible integrity and can be used for decision making processes with high confidence."

Data Integrity Responsibilities

Management. Senior management retains oversight responsibility for the data integrity program and retains ultimate responsibility for execution of the data integrity program elements. Senior management is responsible for providing the resources required to conduct ethics training and operate data integrity evaluation procedures. They also include responsibility for creating an environment of trust among the staff and being the lead advocate for promoting the data integrity policy and the importance of technical ethics. The Quality Assurance Director is the designated ethics officer for the Company.

Staff. The staff is responsible for adhering to the company ethics policy as they perform their duties and responsibilities associated with sample analysis and reporting. By executing this responsibility, data produced by SGS Accutest Inc. retains its high integrity characteristics and withstands the rigors of all data integrity checks.

The staff is also responsible for adhering to all laboratory requirements pertaining to manual data edits, data transcription and data traceability. These include the application of approved manual peak integration and documentation procedures. It also includes establishing traceability for all manual results calculations and data edits.

Ethics Statement. The SGS Accutest Inc. ethics statement reflects the standards that are expected for businesses that provide environmental services to regulated entities and regulatory agencies on a commercial basis. The Ethics Policy is comprised of key elements that are essential to organizations that perform chemical analysis for a fee. As such, it focuses on elements related to personal, technical and business activities.

SGS Accutest Inc. provides analytical chemistry services on environmental matters to the regulated community. The data the company produces provides the foundation for determining the risk presented by a chemical pollutant to human health and the environment. The environmental industry is dependent upon the accurate portrayal of environmental chemistry data. This process is reliant upon a high level of scientific and personal ethics.

It is essential to the Company that each employee understands the ethical and quality standards required to work in this industry. Accordingly, SGS Accutest Inc. has adopted a code of ethics, which each employee is expected to adhere to as follows:

- Perform chemical and microbiological analysis using accepted scientific practices and principles.
- Perform tasks in an honest, principled and incorruptible manner inspiring peers & subordinates.
- Maintain professional integrity as an individual.
- Provide services in a confidential, honest, and forthright manner.
- Produce results that are accurate and defensible.
- Report data without any considerations of self-interest.
- Comply with all pertinent laws and regulations associated with assigned tasks and responsibilities.

Data Integrity Procedures. Four key elements comprise the SGS Accutest Inc. data integrity system. Procedures have been implemented for conducting data integrity training and for documenting that employees conform to the SGS Accutest Inc. Data Integrity and Ethics policy.

The data integrity program consists of routine data integrity evaluation and documentation procedures to periodically monitor and document data integrity. These procedures are documented as SOPs. SOPs are approved and reviewed annually following the procedures employed for all SGS Accutest Inc. SOPs. Documentation associated with data integrity evaluations is maintained on file and is available for review.

Data Integrity Training. SGS Accutest Inc. employees receive technical ethics training during new employee orientation. Employees are also required to refresh their ethical conduct agreement annually, which verifies their understanding of SGS Accutest Inc. ethics policy and their ethical responsibilities. A brochure summarizing the details of the SGS Accutest Inc. Data Integrity Policy is distributed to all employees with the Ethical Conduct Agreement. The refreshed agreement is appended to each individual's training file.

The training focuses on the reasons for technical ethics training, explains the impact of data fraud on human health and the environment, and illustrates the consequences of criminal fraud on businesses and individual careers. SGS Accutest Inc. ethics policy and code of ethics are reviewed and explained for each new employee.

Training on data integrity procedures are conducted by individual departments for groups involved in data operations. These include procedures for manual chromatographic peak integration, traceability for manual calculations and data transcription.

Data Integrity Training Documentation. Records of all data integrity training are maintained in individual training folders. Attendance at all training sessions is documented and maintained in the training archive.

SGS Accutest Inc. Data Integrity and Ethical Conduct Agreement. All employees are required to sign a Data Integrity and Ethical Conduct Agreement annually. This document is archived in individual training files, which are retained for duration of employment.

The Data Integrity and Ethical Conduct Agreement are as follows:

I. *I understand the high ethical standards required of me with regard to the duties I perform and the data I report in connection with my employment at SGS Accutest Inc.*

II. *I have received formal instruction on the code of ethics that has been adapted by SGS Accutest Inc. during my orientation and agree to comply with these requirements.*

III. *I have received formal instruction on the elements of SGS Accutest Inc. Data Integrity Policy and have been informed of the following specific procedures:*

   a. *Formal procedures for the confidential reporting of data integrity issues are available, which can be used by any employee,*

   b. *A data integrity investigation is conducted when data issues are identified that may negatively impact data integrity.*

c. *Routine data integrity monitoring is conducted on sample data, which may include an evaluation of the data I produce,*

IV. *I have read the brochure detailing SGS Accutest Inc. Data Integrity and Ethics Program as required.*

V. *I am aware that data fraud is a punishable crime that may include fines and/or imprisonment upon conviction.*

VI. *I also agree to the following:*

a. *I shall not intentionally report data values, which are not the actual values observed or measured.*

b. *I shall not intentionally modify data values unless the modification can be technically justified through a measurable analytical process.*

c. *I shall not intentionally report dates and times of data analysis that are not the true and actual times the data analysis was conducted.*

d. *I shall not condone any accidental or intentional reporting of inauthentic data by other employees and immediately report it's occurrence to my superiors.*

e. *I shall immediately report any accidental reporting of inauthentic data by myself to my superiors.*

Data Integrity Monitoring. Documented procedures are employed for performing data integrity monitoring. These include regular data review procedures by supervisory and management staff (Section 12.7), supervisory review and approval of manual integrations and periodic reviews of GALP audit trails from the LIMS and all computer controlled analysis.

Data Review. All data produced by the laboratory undergoes at least two levels of review the final review must be performed by a manager, supervisor or designated reviewer. Detected data anomalies that appear to be related to data integrity issues are isolated for further investigation. The investigation is conducted following the procedures described in this section.

Manual Peak Integration Review and Approval. Routine data review procedures for all chromatographic processes includes a review of all manual chromatographic peak integrations. This review is performed by the management staff and consists of a review of the machine integration compared to the manual integration. Manual integrations, which have been performed in accordance with SGS Accutest Inc. manual peak integration procedures, are approved for further processing and release. Identification of samples and analytes in which manual integration had been necessary may be recorded in a report case narrative specific to a particular client and project requirement.

Manual integrations which are not performed to SGS Accutest Inc. specifications are set aside for corrective action, which may include analyst retraining or further investigation as necessary.

Data Integrity Review. Data integrity audits are comprehensive data package audits that include a review of raw data, process logbooks, processed data reports and GALP audit trails from individual instruments and LIMS. GALP audit trails, which record all electronic data activities, are available for the majority of computerized methodology and the laboratory information management system (LIMS). These audit trails are periodically reviewed to determine if interventions performed by technical staff constitute an appropriate action. The review is performed on a recently completed job and may include interviews with the staff who performed the analysis. Findings indicative of inappropriate interventions or data integrity issues are investigated to determine the cause and the extent of the anomaly.

Confidential Reporting of Data Integrity Issues. Data integrity concerns may be raised by any individual to their supervisor. Employees with data integrity concerns should always discuss those concerns with their immediate supervisors as a first step unless the employee is concerned with the confidentiality of disclosing data integrity issues or is uncomfortable discussing the issue with their immediate supervisors. The supervisor makes an initial assessment of the situation to determine if the concern is related to a data integrity violation. Those issues that appear to be violations are documented by the supervisor and referred to the Director of Quality Assurance for investigation.

Documented procedures for the confidential reporting of data integrity issues in the laboratory are part of the data integrity policy. These procedures assure that laboratory staff can privately discuss ethical issues or report items of ethical concern without fears of repercussions with senior staff.

Employees with data integrity concerns that they consider to be confidential are directed to the Corporate Human Resources Manager in Dayton, New Jersey. The HR Manager acts as a conduit to arrange a private discussion between the employee and the Corporate QA Director or a local QA Officer.

During the employee - QA discussion, the QA representative evaluates the situation presented by the employee to determine if the issue is a data integrity concern or a legitimate practice. If the practice is legitimate, the QA representative clarifies the process for the employee to assure understanding. If the situation appears to be a data integrity concern, the QA representative initiates a Data Integrity Investigation following the procedures specified in SOP EQA059.

Data Integrity Investigations. Follow-up investigations are conducted for all reported instances of ethical concern related to data integrity. Investigations are performed in a confidential manner by senior management according to a documented procedure. The outcome of the investigation is documented and reported to the company president who has the ultimate responsibility for determining the final course of action in the matter. Investigation documentation includes corrective action records, client notification information and disciplinary action outcomes, which is archived for a period of five years.

The investigations are conducted by the senior staff and supervisory personnel from the affected area. The investigations team includes the Laboratory Director and the Quality Assurance Director. Investigations are conducted in a confidential manner until it is completed and resolved.

The investigation includes a review of the primary information in question by the investigations team. The team performs a review of associated data and similar historical data to determine if patterns exist. Interviews are conducted with key staff to determine the reasons for the observed practices.

Following data compilation, the investigations team reviews all information to formulate a consensus conclusion. The investigation results are documented along with the recommended course of action.

Corrective Action, Client Notification & Discipline. Investigations that reveal systematic data integrity issues will be referred for corrective action, resolution and disposition (Section 13). If the investigation indicates that an impact to data has occurred and the defective data has been released to clients, client notification procedures will be initiated following the steps in Section 18.7.

In all cases of data integrity violations, some level of disciplinary action will be conducted on the responsible individual. The level of discipline will be consistent with the violation and may range from retraining and/or verbal reprimand to termination. A zero tolerance policy is in effect for unethical actions.

4.0 JOB DESCRIPTIONS OF KEY STAFF

4.1 ***<u>Requirement</u>***: Descriptions of key positions within the organization are defined to ensure that clients and staff understand duties and the responsibilities of the management staff and the reporting relationships between positions.

President/CEO. Responsible for overall process improvement for all business processes. Is also responsible for Quality Assurance, IT Development and Health and Safety. Reports directly to the Board of Directors.

Laboratory Director. Reports to the company President/CEO. Establishes laboratory operations strategy. Direct supervision of client services, organic chemistry, inorganic chemistry, field services, and sample management. Maintains operational responsibility for the designated regional laboratories as defined in the SGS Accutest Inc. Organization Chart. Assumes the responsibilities of the CEO in his absence.

Vice President, Chief Information Officer. Reports to President/CEO. Develops IT Software and hardware agenda. Provides system strategies to compliment company objectives. Maintains all software and hardware used for data handling.

Vice President, Chief Financial Officer. Reports to the company President /CEO. Responsibilities include overseeing the Financial Accounting and Human Resource Department, Corporate Purchasing, Corporate IT Help Desk, and Salary and Benefit Administration.

Director, Quality Assurance. Reports to the company President/CEO and functions independently from laboratory operations. Establishes the company quality agenda, develops quality procedures, provides assistance to operations on quality procedure implementation, coordinates all quality control activities, monitors the quality system, and provides quality system feedback to management to be used for process improvement. Assumes the responsibilities of the Laboratory Director in the absence of the Laboratory Director and the President/CEO.

Director Client Services. Reports to the Laboratory Director. Establishes and maintains communications between clients and the laboratory pertaining to client requirements which are related to sample analysis and data deliverables. Initiates client orders and supervises sample login operations.

Manager, Organics (Organics Technical Director). Reports to the laboratory director. Directs the operations of the organics group, consisting of organics preparation and instrumental analysis. Establishes daily work schedule. Supervises method implementation, application, and data production. Responsible for following Quality System requirements. Maintains laboratory instrumentation in an operable condition. Assumes the responsibilities of the Laboratory Director in his absence.

Manager, Inorganics (Inorganics Technical Director). Reports to the laboratory director. Directs the operations of the inorganics group, consisting of wet chemistry and the metals laboratories. Establishes daily work schedule. Supervises method implementation, application, and data production. Responsible for following Quality System requirements. Maintains laboratory instrumentation in an operable condition. Assumes the responsibilities of the Laboratory Director in his absence.

Manager, Field Services. Reports to the laboratory director. Conducts field sampling and analysis of "analyze immediately" parameters in support of ongoing field projects. Responsible for proper collection, preservation, documentation and shipment of field samples. Maintains field sampling and field instrumentation required to perform primary responsibilities.

Manager, Sample Management. Reports to the laboratory director. Develops, maintains and executes all procedures required for receipt of samples, verification of preservation, and chain of custody documentation. Responsible for maintaining and documenting secure storage, delivery of samples to laboratory units on request and courier services.

Director, Environmental Health and Safety. Reports to the President/CEO. Responsible for developing company safety program and chemical hygiene plan. Reviews and updates these plans annually. Responsible for employee training on relevant health and safety topics. Documents employee training. Manages laboratory waste management program.

Manager, Wet Chemistry. Reports to the Lab Director. Executes daily analysis schedule. Supervises the analysis of samples for wet chemistry parameters using valid, documented methodology. Maintains instrumentation in an operable condition. Reviews data for compliance to quality and methodological requirements. Assumes the responsibilities of the Inorganics Manager in his absence.

Manager, Metals. Reports to the Lab Director. Executes daily analysis schedule. Supervises the analysis of samples for metallic elements using valid, documented methodology. Documents all procedures and data production activities. Maintains instrumentation in an operable condition. Reviews data for compliance to quality and methodological requirements.

Manager, Organic Preparation. Reports to the Lab Director. Executes the daily sample preparation schedule. Performs the extract of multi-media samples for organic constituents using valid, documented methodology. Prepares documentation for extracted samples. Assumes custody until transfer for analysis.

Technical Support Supervisor, Organics. Reports to the organic manager. Oversees all instrument maintenance and new equipment installation. Conducts method development and implementation tasks.

Manager, Semi VOA. Reports to the Lab Director. Expedites the analysis of samples and sample extracts. Executes daily analysis schedule. Supervises the analysis of samples for organic parameters using valid, documented methodology. Documents all data and data production activities. Maintains instrumentation in an operable condition. Reviews data for compliance to quality and methodological requirements. Assumes the responsibilities of the Organics Manager in his absence.

Supervisor, Report Generation. Reports to the organics manager. Compiles raw and processed sample data and assembles into client-ready reports. Initiates report scanning for archiving purposes. Maintains raw batch data in accessible storage. Mails completed reports to clients according to specified report turnaround schedule.

Quality Assurance Officers. Reports to the Director, Quality Assurance. Performs quality control data review for trend monitoring purposes. Conducts internal audits and prepares reports for management review. Oversees proficiency testing program. Process quality control data for statistical purposes. Assumes the responsibilities of the Quality Assurance Director in his absence.

4.2 ***Employee Screening, Orientation, and Training***.

All potential laboratory employees are screened and interviewed by human resources and technical staff prior to their hire. The pre-screen process includes a review of their qualifications including education, training and work experience to verify that they have adequate skills to perform the tasks of the job.

Newly hired employees receive orientation training beginning the first day of employment by the Company. Orientation training consists of initial health and safety training including general laboratory safety, personal protection and building evacuation. Orientation also includes quality assurance program training, data integrity training, and an overview of the Company's goals, objectives, mission, and vision.

All technical staff receives training to develop and demonstrate proficiency for the methods they perform. New analysts work under supervision until the supervisory staff is satisfied that a thorough understanding of the method is apparent and method proficiency has been demonstrated, through a precision and accuracy study that has been documented, reviewed and approved by the QA Staff. Data from the study is compared to method acceptance limits. If the data is unacceptable, additional training is required. The analyst may also demonstrate proficiency by producing acceptable data through the analysis of an independently prepared proficiency sample.

Individual proficiency is demonstrated annually for each method performed. Data from initial and continuing proficiency demonstrations are archived in the individual's training folder.

4.3 ***Training Documentation***. The human resources department prepares a training file for every new employee. All information related to qualifications, experience, external training courses, and education are placed into the file. Verification documentation for orientation, health & safety, quality assurance, and ethics training is also included in the file.

Additional training documentation is added to the file as it is developed. This includes documentation of SOP understanding, data for initial and continuing demonstrations of proficiency, performance evaluation study data and notes and attendance lists from group training sessions.

The Quality Assurance Department maintains the employee training database. This database is a comprehensive inventory of training documentation for each individual employee. The database enables supervisors to obtain current status information on training data for individual employees on a job specific basis. It also enables the management staff to identify training documentation in need of completion.

Employee specific database records are created by human resources on the date of hire. Data base fields for job specific requirements such as SOP documentation of understanding and annual demonstration of analytical capability are automatically generated when the supervisor assigns a job responsibility. Employees acknowledge that their SOP responsibilities have been satisfied using a secure electronic process which updates the database record. Reports are produced which summarize the qualifications of individual employees or departments.

5.0 SIGNATORY APPROVALS

Requirement: Procedures have been developed for establishing the traceability of data and documents. The procedure consists of a signature hierarchy, indicating levels of authorization for signature approvals of data and information within the organization. Signature authority is granted for approval of specific actions based on positional hierarchy within the organization and knowledge of the operation that requires signature approval. SOP EQA032 Signature Authority explains the process of SGS Accutest Inc. Signature Authority and the use of electronic signatures in the laboratory. A log of signatures and initials of all employees is maintained by the QA Staff for cross-referencing purposes.

5.1 ***Signature Hierarchy***.

President/CEO. Approval of quality assurance policy in lieu of the Director, Quality Assurance. IT Development and Health and Safety purchase approvals in Lieu of IT and H & S managers.

Laboratory Director. Approval of final reports in the absence of the President. Approval of SOPs, project specific QAPs, data review and approval in lieu of technical managers. Establishes and implements technical policy.

Vice President, Chief Information Officer. Department specific supplies purchase. MIS policy.

Director, Quality Assurance. Approval of final reports and quality assurance policy in the absence of the President. Approval of SOPs, project specific QAPs, data review and approval in lieu of technical managers.

Director, Client Services. QAP and sampling and analysis plan approval. Project specific contracts, pricing, and price modification agreements. Approval and acceptance of incoming work, Client services policy.

Managers, Technical Departments. Methodology and department specific QAPs. Data review and approval, department specific supplies purchase. Technical approval of SOPs.

Manager, Sample Management. Initiation of laboratory sample custody and acceptance of all samples. Approval of department policies and procedures. Department specific supplies purchase.

Director, Environmental Health & Safety. Approval of health and safety policy in the absence of the President. Approval of health and safety SOPs. Waste manifesting and approval.

Assistant Managers: Technical Departments. Data review approval, purchasing of expendable supplies.

Supervisor, Field Services. Sampling plan design and approval. Data review for field parameters. State form certification. Department policies and procedures. Department specific supplies purchase.

Supervisors, Technical Departments. Data review approval, purchasing of expendable supplies.

5.2 ***Signature Requirements***. All laboratory activities related to sample custody and generation or release of data must be approved using either initials, signatures or electronic, password protected procedures. The individual, who applies his signature initial or password to an activity or document, is authorized to do so within the limits assigned to them by their supervisor. All written signatures and initials must be applied in a readable format that can be cross-referenced to the signatures and initials log if necessary.

5.3 ***Signature and Initials Log***. The QA group maintains a signature and initials log. New employee signatures and initials are appended to the log on the first day of employment. Signature of individuals no longer employed by the company are retained, but annotated with their date of termination.

5.4 ***Electronic Signature Log.*** Key technical staff will sign a liability document for their signatures designating the use of their electronic signatures on an annual basis. Quality Assurance team keeps a wet copy of these signatures on form QA115.

6.0 DOCUMENTATION & DOCUMENT CONTROL

Requirement: Document control policies have been established which specify that any document used as an information source or for recording analytical or quality control information must be managed using defined document control procedures. Accordingly, policies and procedures required for the control, protection, and storage of any information related to the production of analytical data and the operation of the quality system to assure its integrity and traceability have been established and implemented in the laboratory. The system contains sufficient controls for managing, archiving and reconstructing all process steps which contributed to the generation of an analytical test result. Using this system, an audit trail for reported data can be produced, establishing complete traceability for the result.

6.1 ***Administrative Records***. Administrative (non-analytical) records are managed by the quality assurance department. These records consist of electronic documents which are retained in a limited access electronic directory or paper documents, which are released to the technical staff upon specific request.

Form Generation, Modification & Control. The quality assurance group approves and manages all forms used as either stand-alone documents or in logbooks to ensure their traceability. Forms are generated as computer files only and are maintained in a limited access master directory. The QA staff also manages and approves modifications to existing forms. Obsolete editions of modified forms are retained for seven years.

Approved forms are assigned a 5-character alphanumeric code. The first two alpha characters designate the department that uses the form; the next three digits are sequentially assigned number.

New forms must include the name SGS Accutest Inc. and appropriate spaces for signatures of approval and dates. Further design specifications are the responsibility of the originating department.

The technical staff is required to complete all forms to the maximum extent possible. If information for a specific item is unavailable, the analyst is required to "Z" the information block. The staff is also required to "Z" the uncompleted portions of a logbook or logbook form if the day's analysis does not fill the entire page of the form.

Logbook Control. All laboratory logbooks are controlled documents that are comprised of approved forms used to document specific processes. New logs are numbered and issued to a specific individual who is assigned responsibility for the log. Old logs are returned to QA for entry into the document archive system where they are retained for seven (7) years. Laboratory staff may hold a maximum of two consecutively dated logbooks of the same type in the laboratory including the most recently issued book to simplify review of recently completed analysis. The Organic prep department maintains multiple active copies of prep logbooks to facilitate production.

Controlled Documents. Key laboratory documents that are distributed internally and externally are numbered for tracking purposes. Individuals receiving documents, who must be informed when changes occur, receive controlled copies of those documents. Controlled status simplifies document updates and retrieval of outdated documents. Control is maintained through a document numbering procedure and document control logbook which identifies the individual receiving the controlled document and the date of receipt. Key documents are also distributed as uncontrolled documents if the recipient does not require updated copies when changes occur. Key documents in uncontrolled status are numbered and tracked using the same procedures as controlled documents.

Quality Systems Manual (QSM). All QSMs are assigned a number prior to distribution. The number, date of distribution, and identity of the individual receiving the document are recorded in the document control logbook. The numbering system is restarted with each new volume, which corresponds to the annual revision of the QSM. Electronic versions are distributed as read only files that are password protected.

Standard Operating Procedures (SOPs). SOPs are maintained by pre-designating the numbers of official copies of documents that are placed into circulation within the laboratory. Official documents are copied to green paper and placed into the appropriate laboratory section as follows:

Administrative: One master copy for the administrative file.

Sample Management: One controlled green copy for the sample management file.

Organics Laboratories: Two controlled green copies, one for the affected laboratory area, and one for the organics laboratory file.

Inorganics Laboratories: Two controlled green copies, one for the affected laboratory area, and one for the inorganics laboratory file.

Field Services: One controlled green copy for each field sampling team (generally a single field technician).

The original, signed copy of the SOP is maintained in the master SOP binder by the QA staff. The QA staff collects outdated versions of SOPs as they are replaced and archived for a period of seven (7) years in the QA archives. Electronic versions of outdated SOPs are moved from the active SOP directory to the inactive directory.

6.2 ***Technical Records***. All records related to the analysis of samples and the production of an analytical result are archived in secure document storage or on electronic media and contain sufficient detail to produce an audit trail which re-creates the analytical result. These records include information related to the original client request, bottle order, sample login and custody, storage, sample preparation, analysis, data review and data reporting.

Each department involved in this process maintains controlled documents which enable them to maintain records of critical information relevant to their department's process.

6.3 ***Quality Control Support Data & Records***. All information and data related to the quality system is stored in a restricted access directory on the network server. Information on this directory is backed-up daily. Users of the quality assurance information and data have "read-only" access to the files contained in the directory. The QA staff and the laboratory director have write capability in this directory.

This directory contains all current and archived quality system manuals, SOPs, control limits, MDL studies, precision and accuracy data, official forms, internal audit reports, proficiency test scores and metrics calibration information.

The following information is retained in the directory:

- Quality System Manuals
- Standard Operating Procedures
- ASTM & NIST Methods
- Bottleware & Preservative QC Data
- Certification Documentation
- Change Management Data
- External Audit Reports
- Internal Audit Reports
- Corrective Action Database
- Laboratory Forms Directory
- Health & Safety Manuals
- Inactive Standard Operating Procedures
- Method Detection Limit Data
- Metrics Inventory & Calibration Data
- Performance Limits
- Proficiency Test Scores & Statistics
- Project Specific Analytical Requirements
- QC Report Reviews
- Regulatory Agency Quality Documents
- Staff Bios And Job Descriptions
- State Specific Methods

6.4 ***Analytical Records***. All data related to the analysis of field samples are retained as either paper or electronic records that can be retrieved to compile a traceable audit trail for any reported result. All information is linked to the client job and sample number, which serves as a reference for all sample related information tracking.

Critical times in the life of the sample from collection through analysis to disposal are documented. This includes date and time of collection, receipt by the laboratory, preparation times and dates, analysis times and dates and data reporting information. Analysis times are calculated in hours for methods where holding time is specified in hours ($\leq$72 hours).

Sample preparation information is recorded in a separate controlled logbook. It includes sample identification numbers, types of analysis, preparation and cleanup methods, sample weights and volumes, reagent lot numbers and volumes and any other information pertinent to the preparation procedure.

Information related to the identification of the instrument used for analysis is permanently attached to the electronic record. The record includes an electronic data file that indicates all instrument conditions employed for the analysis, including the type of analysis conducted. The

analyst's identification is electronically attached to the record. The instrument tuning and calibration data is electronically linked to the sample or linked though paper logs which were used in the documentation of the analysis. Quality control and performance criteria are permanently linked to the paper archive or electronic file.
Paper records for the identity, receipt, preparation and evaluation of all standards and reagents used in the analysis are documented in prepared records and maintained in controlled documents or files. Lot number information linking these materials to the analysis performed is recorded in the logbooks associated with the samples in which they were used.

Manual calculations or peak integrations that were performed during the data review are retained as paper or scanned documents and included as part of the electronic archive. Signatures for data review are retained on paper or as scanned versions of the paper record for the permanent electronic file.

6.5 ***Confidential Business Information (CBI).*** Operational documents including SOPs, Quality Manuals, personnel information, internal operations statistics, and laboratory audit reports are considered confidential business information. Strict controls are placed on the release of this information to outside parties.

Release of CBI to outside parties or organizations may be authorized upon execution of a confidentiality agreement between SGS Accutest Inc. and the receiving organization or individual. CBI information release is authorized for third party auditors and commercial clients in electronic mode as Adobe Acrobat .PDF format only.

6.6 ***Software Change Documentation & Control.*** Changes to software are documented as text within the code of the program undergoing change. Documentation includes a description of the change, reason for change and the date the change was placed into effect. Documentation indicating the adequacy of the change is prepared following the evaluation by the user who requested the change.

6.7 ***Report and Data Archiving*.** SGS Accutest Inc. produces digital files of all raw and processed data which is maintained for a minimum period of seven (7) years. The archived files consist of all raw data files and source documents associated with the analysis of field samples and proficiency test samples. Data files and source documents associated with method calibration and project and method quality control are also archived. After seven years, the files may be discarded unless contractual arrangements exist which dictate different requirements. Client or regulatory agency specific data retention practices are employed for several government organizations such as the Department of Defense and the Massachusetts Department of Environmental Protection that require a retention period of ten (10) years. Data archiving may also be extended up to ten (10) years for specific commercial clients in response to contractual requirements.

Complete date and time stamped PDF reports are generated automatically from the laboratory information management system (LIMS) using the source documents archived on the document server. These source documents are maintained on a document server and archived to primary and clone tapes. The primary tapes remain on premises while the clone tapes are taken to a secure offsite location for permanent storage. Both the primary and clone tapes remain in storage for the remainder of the archive period.

6.8 ***Training***. The company maintains a training record for all employees that documents that they have received instruction on administrative and technical tasks that are required for the job they perform. Training records for individuals employed by the company are retained for a period of six months following their termination of employment.

Training File Origination. The Human Resources Group (HR) initiates training files. The QA staff, through the Quality Assurance officer, retains the responsibility for the maintenance and tracking of all training related documentation in the file. The file is begun on the first day of employment. Information required for the file includes a copy of the individual's most current resume, detailing work experience and a copy of any college diplomas and transcript(s). Information added on the first day includes documentation of health and safety training, quality assurance training and a signed data integrity training and ethical conduct agreement.

Training documentation, training requirements, analyst proficiency information and other training related support documentation is tracked using a customized database application (Section 4.3). Database extracts provide an itemized listing of specific training requirements by job function. Training status summaries for individual analysts portray dates of completion for job specific training requirements.

6.9 ***Technical Training***. The supervisor of each new employee is responsible for developing a training plan for each new employee. The supervisor evaluates the employees training progress at regular frequencies. Supporting documentation, including demonstration of capability and precision and accuracy studies, which demonstrate an analyst's proficiency for a specific test, are added to the training file as completed. Employees and supervisors verify documentation of understanding (DOU) for all assigned standard operating procedures in the training database. Certificates or diplomas for any off-site training are also added to the file.

7.0 REFERENCE STANDARD TRACEABILITY

Requirement: Documented procedures, which establish traceability between any measured value and a national reference standard, are established by the laboratory as required. All metric measurements are traceable to NIST reference weights or thermometers that are calibrated on a regular schedule. All chemicals used for calibration of a quantitative process are traceable to an NIST reference that is documented by the vendor using a certificate of traceability. The laboratory maintains a documentation system that establishes the traceability links. The procedures for verifying and documenting traceability are documented in standard operating procedures.

7.1 ***Traceability of Metric Measurements - Thermometers***. SGS Accutest Inc. uses NIST thermometers to calibrate commercially purchased thermometers prior to their use in the laboratory and annually thereafter for liquid in glass thermometers or quarterly for electronic temperature measuring devices. If necessary, thermometers are assigned correction factors that are determined during their calibration using an NIST thermometer as the standard. The correction factor is documented in a thermometer calibration database and on a tag attached to the thermometer. The correction factor is applied to temperature measurements before recording the measurement in the temperature log. Calibration of each thermometer is verified and documented on a regular schedule. The NIST thermometer is checked for accuracy by an ISO 17025 approved vendor every five (5) years following the specifications for NIST thermometer calibration verification detailed in the united States Environmental Protection Agency's "Manual for the Certification of Laboratories Analyzing Drinking Water", Fifth Edition, February2005.

7.2 ***Traceability of Metric Measurements – Calibration Weights***. SGS Accutest Inc. uses calibrated weights, which are traceable to NIST standard weights to calibrate all balances used in the laboratory. Balances are calibrated to specific tolerances within the intended use range of the balance. Calibration checks are required on each day of use. If the tolerance criteria are not achieved, corrective action specified in the balance calibration SOP is applied before the balance can be used for laboratory measurements. Recalibration of all calibration weights is conducted and documented on a biannual basis.

7.3 ***Traceability of Chemical Standards***. All chemicals, with the exception of bulk dry chemicals and acids, purchased as reference standards for use in method calibration must establish traceability to NIST referenced material through a traceability certificate. Process links are established that enable a calibration standard solution to be traced to its NIST reference certificate.

Chemical standards used for analysis must meet the purity specifications of the method. These specifications must be stated in the reagents section of the method SOP.

7.4 ***Assignment of Reagent, Bulk Chemical and Standard Expiration Dates.*** Expiration date information for all purchased standards, prepared standard solutions and selected reagents is provided to SGS Accutest Inc. by the vendor as a condition of purchase. Neat materials, bulk chemicals including solvents, acids and inorganic reagents are not required to be purchased with expiration dates. An expiration date of five (5) years from the date of receipt shall be established. Prepared solutions are labeled with the expiration date provided by the manufacturer. In-house prepared solutions are assigned expiration dates that are consistent with the method that employs their use unless documented experience indicates that an alternate date can be applied. If alternate expiration dates are employed, their use is documented in the method SOP. Expiration dates for prepared inorganic reagents, which have not exhibited instability, are established at two years from the date of preparation for tracking purposes.

The earliest expiration date has been established as the limiting date for assigning expiration dates to prepared solutions. The assignments of expiration dates that are later than the expiration date of any derivative solution or material are prohibited.

7.5 ***Documentation of Traceability***. Traceability information is documented in individual logbooks designated for specific measurement processes. The quality assurance group maintains calibration documentation for metric references in separate logbooks.

Balance calibration verification is documented in logbooks that are assigned to each balance. The individual conducting the calibration is required to initial and date all calibration activities. Any defects that occur during calibration are also documented along with the corrective action applied and a demonstration of return to control. Annual service reports and certificates are retained on file by the QA staff.

Temperature control is documented in logbooks or an electronic temperature monitoring database assigned to the equipment being monitored. A calibrated thermometer or probe is assigned to each individual item. Uncorrected and corrected measurements are recorded. Logbooks document with the date and initials of the individual conducting the measurement on a daily or as used basis. The temperature database records temperatures automatically every 15 minutes. Corrective action, if required, is also documented including the demonstration of return to control.

Initial traceability of chemical standards is documented via a vendor-supplied certificate (not available for bulk dry chemicals and acids) that includes lot number, expiration date and certified concentration information. Solutions prepared using the vendor supplied chemical standards are documented in logbooks assigned to specific analytical processes. Alternatively, documentation may be entered into the electronic standards and reagent tracking log. The documentation includes links to the vendor's lot number, an internal lot number, and dates of preparation, expiration date, and the preparer's initials.

SGS Accutest Inc. employs commercially prepared standard solutions whose traceability can be demonstrated through a vendor supplied certificate of analysis that includes an experimental verification of the standard's true concentration. The test value for the verification analysis must agree within 1% of the vendor's true value before it can be employed for calibration purposes. If the test value differs from the nominal value by more than 1%, then the test value is used as the true value in laboratory calibrations and calculations. Purchased standards which do not have a certificate of analysis cannot be used for calibration or calibration verification purposes and are rejected or returned to the vendor.

Supervisors conduct regular reviews of logbooks, which are verified using a signature and date.

8.0 TEST PROCEDURES, METHOD REFERENCES, AND REGULATORY PROGRAMS

Requirements: The laboratory employs client specified or regulatory agency approved methods for the analysis of environmental samples. A list of active methods is maintained, which specifies the type of analyses performed and cross-references the methods to applicable environmental regulations. Routine procedures used by the laboratory for the execution of a method are documented in standard operating procedures. Method performance and sensitivity are demonstrated annually where required. Defined procedures for the use of method sensitivity limits for data reporting purposes are established by the Director of Quality Assurance and used consistently for all data reporting purposes.

8.1 ***Method Selection & Application***. SGS Accutest Inc. employs methods for environmental sample analysis that are consistent with the client's application, which are appropriate and applicable to the project objectives. SGS Accutest Inc. informs the client if the method proposed is inappropriate or outdated and suggests alternative approaches.

SGS Accutest Inc. employs documented, validated regulatory methods in the absence of a client specification and informs the client of the method selected. These methods are available to the client and other parties as determined by the client. Documented and validated in-house methods may be applied if they are appropriate to the project. The client is informed of the method selection.

8.2 ***Standard Operating Procedures***. Standard operating procedures (SOP) are prepared for routine methods executed by the laboratory, processes related to laboratory operations and sample or data handling. All SOPs are formatted to meet the specifications established by the National Environmental Laboratory Accreditation Conference, which are detailed in Chapter Five – Quality Systems of the established Standards. The procedures describe the process steps in sufficient detail to enable an individual, who is unfamiliar with the procedure to execute it successfully.

SOPs are evaluated annually and edited if necessary. Reviewed SOPs that do not require modification include an evaluation summary form indicating that an evaluation was conducted and modifications were not needed. SOPs can be edited on a more frequent basis if changes are required for any reason. These may include a change to the methodology, elimination of systematic errors that dictate a need for process changes or modifications to incorporate a new version of the method promulgated by the originating regulatory agency. Procedural modifications are indicted using a revision number. SOPs are available for client review at the SGS Accutest Inc. facility upon request.

The complete list of the laboratories SOPs available as of the date of publication of this QSM version are detailed in Appendix II.

8.3 ***Method Validation***. Standard methods from regulatory sources are primarily used for all analysis. Standard methods do not require validation by the laboratory. Non-standard, in-house methods are validated prior to use. Validation is also performed for standard methods applied outside their intended scope of use. Validation is dependent upon the method application and may include analysis of quality control samples to develop precision and accuracy information for the intended use. A final method validation report is generated, which includes all data in the validation study. A statement of adequacy and/or equivalency is included in the report. A copy of the report is archived in the quality assurance directory of the company server.

Non-standard methods are validated prior to use. This includes the validation of modified standard methods to demonstrate comparability with existing methods. Demonstrations and validations are performed and documented prior to incorporating technological enhancements and nonstandard methods into existing laboratory methods used for general applications. The demonstration includes method specific requirements for assuring that significant performance differences do not occur when the enhancement is incorporated into the method. Validation is dependent upon method application and may include the analysis of quality control samples to develop precision and accuracy information for intended use.

The study procedures and specifications for demonstrating validation include comparable method sensitivity, calibration response, method precision; method accuracy and field sample consistency for several classes of analytical methods are detailed in this document. These procedures and specifications may vary depending upon the method and the modification.

8.4 ***Estimated Uncertainty.*** A statement of the estimated uncertainty of an analytical measurement accompanies the test result when required. Estimated uncertainty is derived from the performance limits established for spiked samples of similar matrices. The degree of uncertainty is derived from the negative or positive bias for spiked samples accompanying a specific parameter. When the uncertainty estimate is applied to a measured value, the possible quantitative range for that specific parameter at that measured concentration is defined. Well recognized regulatory methods that specify values for the major sources of uncertainty and specify the data reporting format do not require a further estimate of uncertainty.

8.5 ***Demonstration of Capability***. Confirmation testing is conducted to demonstrate that the laboratory is capable of performing the method before its application to the analysis of environmental samples. The results of the demonstration tests are compared to the quality control specifications of the method to determine if the performance is acceptable.

Capability demonstrations are conducted initially for every analyst on each method performed and annually on a method specific basis thereafter. Acceptable demonstrations are documented for individual training files and retained by the QA staff. New analytes, which are added to the list of analytes for an accredited method, are evaluated for applicability through a demonstration of capability similar to those performed for accredited analytes.

8.6 ***Method Detection Limit Determination***. Annual method detection limit (MDL) studies are performed as appropriate for routine methods used in the laboratory. MDL studies are also performed when there is a change to the method that affects how the method is performed or when an instrumentation change that impacts sensitivity occurs. The procedure used for determining MDLs is described in 40 CFR, Part 136, and Appendix B. Studies are performed for each method on water, soil and air matrices for every instrument that is used to perform the method. MDLs are established at the instrument level. The highest MDL of the pooled instrument data is used to establish a laboratory MDL. MDLs are experimentally verified through the analysis of spiked quality control samples at 1-4 times the concentration of the experimental MDL. The verification is performed on every instrument used to perform the analysis. The quality assurance staff manages the annual MDL determination process and is responsible for retaining MDL data on file. Approved MDLs are appended to the LIMS and used for data reporting purposes.

8.7 ***Limit of Detection (LOD).*** For the DoD ELAP the limit of detection (LOD) for each method and target analyte of concern is established for each instrument that is used to perform the method. The LOD is established by initially spiking a water and/or soil matrix at approximately two to three times the calculated MDL (for a single-analyte standard) or two to four times the calculated MDL (for a multi-analyte standard). The LOD undergoes all sample processing steps and is validated by the qualitative identification of the analytes of interest. The spike concentration establishes the LOD and must be verified quarterly. If the spike concentration in the LOD cannot be verified at the initial level with appropriate analytical quality control, a higher LOD must be defined and verified.

8.8 ***Instrument Detection Limit Determination***. Instrument detection limits (IDLs) are determined for all inductively coupled argon plasma emission spectrophotometers and mass spectrometers. The IDL is determined for the wavelength (emission) of each element and the ion (mass spectrometry) of each element used for sample analysis. The IDL data is used to estimate instrument sensitivity in the absence of the sample matrix. IDL determinations are conducted at the frequency specified in the appropriate SOPs' for ICP and ICP/MS analysis.

8.9 ***Method Reporting Limit.*** The method reporting limit for organic methods is determined by the concentration of the lowest calibration standard in the calibration curve. This value is adjusted based on several sample preparation factors including sample volume, moisture content (soils), digestion, distillation or dilution. The low calibration standard is selected by department managers as the lowest concentration standard that can be used for calibration while continuing to meet the calibration linearity criteria of the method being used. The validity of the method reporting limits are confirmed through the analysis of a spiked quality control sample at the method reporting limit concentration. By definition, detected analytes at concentrations below the low calibration standard cannot be accurately quantitated and are qualified as estimated values.

The reporting limit for inorganics methods is defined as the concentration which is greater than the MDL where method quality control criteria has been achieved. The reporting limit for general chemistry methods employing multiple point calibrations must be greater than or equal to the concentration of the lowest standard of the calibration range.

The reporting limit established for both organic and inorganic analysis is above the calculated method detection limit where applicable.

8.10 ***Limit of Quantitation (LOQ).*** For the DoD ELAP the limit of quantitation (LOQ) for each analyte of concern is determined. The LOQ is set within the range of calibration is greater than the established LOD. Precision and bias criteria for the LOQ are established to meet client requirements and are verified quarterly.

8.11 ***Reporting of Quantitative Data.*** Analytical data for all methods is reported without qualification to the reporting limit established for each method. Data, for organic methods may be reported to the established method detection limit depending upon the client's requirements provided that all qualitative identification criteria for the detected parameter have been satisfied. All parameters reported at concentrations between the reporting limit and the method detection limit are qualified as estimated.

Data for inorganic methods are reported to the established method reporting limits. Inorganic data for specific methods may also be reported to the established method detection limit at client request. However, this data is always qualified as estimated.

Measured concentrations of detected analytes that exceed the upper limit of the calibration range are either diluted into the range and reanalyzed or qualified as an estimated value. The only exception to this applies to ICP and ICP/MS analysis, which can be reported to the upper limit of the experimentally determined linear range without qualification.

8.12 ***Precision and Accuracy Studies***. Annual precision and accuracy (P&A) studies, which demonstrate the laboratories ability to generate acceptable data, are performed for all routine methods used in the laboratory. The procedure used for generating organic P&A data is referenced in the majority of the regulatory methodology in use. The procedure requires quadruplicate analysis of a sample spiked with target analytes at a concentration in the working range of the method. This data may be compiled from a series of existing blank spikes or laboratory control samples. Accuracy (percent recovery) of the replicate analysis is averaged and compared to established method performance limits. Values within method limits indicate an acceptable performance demonstration. Precision and accuracy date is also used to annually demonstrate analytical capability for individual analysts. Annual demonstration of capability data is archived in individual training files.

Performance Limits. The Quality Assurance Director is responsible for compilation and maintenance of all precision and accuracy data used for performance limits. Quality control data for all test methods are accumulated and stored in the laboratory information management system (LIMS). Parameter specific QC data are extracted semi-annually for methods 8260, 8270, 8081, 8082 and annually for remaining methods. Each method is statistically processed to develop laboratory specific warning limits and control limits. The new limits are reviewed and approved by the supervisory staff prior to their use for data assessment. The new limits are used to evaluate QC data for compliance with method requirements for a period of one year. Laboratory generated limits appear on all data reports.

8.13 ***Method Sources & References.*** The Quality Assurance Staff maintains a list of active methods used for the analysis of samples. This list includes valid method references from sources such as USEPA, ASTM or Standard Methods designations and the current version and version date.

Updated versions of approved reference methodology are placed into use as changes occur. The Quality Assurance Director informs operations management of changes in method versions as they occur. The operations management staff selects an implementation date. The operations staff is responsible for completing all method use requirements prior to the implementation date. This includes modification of SOPs, completion of MDL and precision and accuracy studies and staff training. Documentation of these activities is provided to the QA staff who retains this information on file. The updated method is placed into service on the implementation date and the old version is de-activated.

Multiple versions of selected methods may remain in use to satisfy client specific needs. In these situations, the default method version becomes the most recent version. Client specific needs are communicated to the laboratory staff using method specific analytical method codes, which clearly depict the version to be used. The old method version is maintained as an active method until the specified client no longer requires the use of the older version.

SGS Accutest Inc. will not use methodology that represents significant departures from the reference method unless specifically directed by the client. If clients direct the laboratory to use a method modification that represents a significant departure from the reference method, the request will be documented in the project file.

8.14 ***Analytical Capabilities***. Appendix III provides a detailed listing of the methodology employed for the analysis of test samples.

9.0 SAMPLING, SAMPLE MANAGEMENT, LOGIN, CUSTODY, STORAGE AND DISPOSAL

Requirement: The laboratory must employ a system which ensures that client supplied product or supplied product (the sample) is adequately evaluated, acknowledged, and secured upon delivery to the laboratory. The system also assures that product chain of custody is maintained and that sample receipt conditions and preservation status are documented and communicated to the client and internal staff. The login procedure assigns, documents, and maps the specifications for the analysis of each unique sample to assure that the requested analysis is performed on the correct sample and enables the sample to be tracked throughout the laboratory analytical cycle. The system includes procedures for reconciling defects in sample condition or client provided data, which are identified at sample arrival. The system specifies the procedures for proper sample storage, transfer to the laboratory, and disposal after analysis. The system is also documented in standard operating procedures.

9.1 ***Order Receipt and Entry***. New orders are initiated and processed by the client services group (See Chapter 14, Procedures for Executing Client Specifications). The new order procedure includes mechanisms for providing bottles to clients, which meet the size, cleanliness, and preservation specifications for the analysis to be performed.

For new orders, the project manager prepares a bottle request form, which is submitted to sample management. This form provides critical project details to the sample management staff, which are used to prepare and assemble the sample bottles for shipment to the client prior to sampling.

The bottle order is assembled using bottles that meet USEPA specifications for contaminant free sample containers. SGS Accutest Inc. uses a combination of commercially supplied pre-cleaned bottles and bottles that have been tested for residual contamination and verified to meet USEPA specifications prior to use. Sterile bottles for microbiological samples are purchased from commercial sources.

Bottles, which are not purchased pre-cleaned, are checked to assure that they are free of contamination from targeted analytes before being released for use. Sterile bottles are checked for contamination with each lot. The QA staff retains a copy of the documentation of in-house contamination and sterility checks and maintains the responsibility for approving and releasing bottle lots for use following a review of the check data.

Preservative solutions that are specified for the analysis requested are dispensed into the sample bottle prior to shipment. All preservative solutions are prepared in the laboratory or purchased from commercial suppliers. Each solution is checked to assure that it is free of contamination from the compounds being analyzed before being released for use.

Reagent water for trip and field blanks is poured into appropriately labeled containers. All bottles are packed into ice chests with blank chain of custody forms and the original bottle order form. Completed bottle orders are delivered to clients using SGS Accutest Inc. couriers or commercial carriers for use in field sample collection.

9.2 ***Sampling***. Documented procedures are employed by the field staff for field sample collection and are accessible during sample collection activities. Field activities are documented in controlled notebooks which detail relevant field conditions, site data and the results of field measurements. Appropriate custody procedures for collected samples are initiated by the field staff at the time of sample collection. Samples are documented, labeled and preserved according to the specifications of the method and/or regulatory program prior to being shipped to the laboratory.

9.3 ***Sample Receipt and Custody***. Samples are delivered to the laboratory using a variety of mechanisms including SGS Accutest Inc. couriers, commercial shippers, and client self-delivery. Documented procedures are followed for arriving samples to assure that custody and integrity are maintained and handling/ preservation requirements are documented and maintained.

Sample custody documentation is initiated when the individual collecting the sample collects field samples. Custody documentation includes all information necessary to provide an unambiguous record of sample collection, sample identification, and sample collection chronology. Initial custody documentation employs either SGS Accutest Inc. or client generated custody forms.

SGS Accutest Inc. generates a chain of custody in situations where the individuals who collected the sample did not generate custody documentation in the field.

SGS Accutest Inc. defines sample custody as follows:

∴ The sample is in the actual custody or possession of the assigned responsible person,

∴ The sample is in a secure area.

The SGS Accutest Inc. facility is defined as a secure facility. Perimeter security has been established, which limits access to authorized individuals only. Visitors enter the facility through the building lobby and must register with the receptionist prior to entering controlled areas. While in the facility, visitors are required to wear a visitor's badge and must be accompanied by their hosts at all times. After hours, building access is controlled using a computerized passkey reader system. This system limits building access to individuals with a pre-assigned authorization status. After hours visitors are not authorized to be in the building. Clients delivering samples after hours must make advanced arrangements through client services and sample management to assure that staff is available to take delivery and maintain custody.

Upon arrival at SGS Accutest Inc., the sample custodian reviews the chain of custody for the samples received to verify that the information on the form corresponds with the samples

delivered. This includes verification that all listed samples are present and properly labeled, checks to verify that samples were transported and received at the required temperature, verification that the sample was received in proper containers, verification that sufficient volume is available to conduct the requested analysis, and a check of individual sample containers to verify test specific preservation requirements including the absence of headspace for volatile compound analysis.
Sample conditions and other observations are documented on the chain of custody by the sample custodian prior to completing acceptance of custody and in an online database that creates a permanent record of all sample login activities. The sample custodian accepts sample custody upon verification that the custody document is correct. Discrepancies or non-compliant situations are documented and communicated to the SGS Accutest Inc. project manager, who contacts the client for resolution. The resolution is documented and communicated to sample management for execution.

The sample management staff maintains an electronic sample receipt log. This log details all sample-related information in a searchable database that is updated upon data entry and backed up daily. The log records include critical date information, numbers of samples, numbers of bottles for each parameter, descriptions of bottles for each parameter, preservation conditions, bottle refrigerator location, and bottle conditions. Data entry into the log is secured using individual passwords.

During initial login, each bottle is assigned a unique number and is labeled with a barcode corresponding to that number. A bar-coding and scanning system electronically tracks sample custody transfers between individuals within the laboratory. Internal custody documentation may be required for compliance with regulatory agency or contractual specifications. A documented, chronological record of each sample transfer identifying each individual having possession of the sample is created in the laboratory information management system, which can be printed and included in data reports to demonstrate continuous custody.

9.4 ***Laboratory Preservation of Improperly Preserved Field Samples.*** SGS Accutest Inc. will attempt to preserve field samples that were received without proper preservation to the extent that it is feasible and supported by the methods in use. Laboratory preservation of improperly preserved or handled field samples is routinely performed for metals samples. Special handling procedures may also be applied to improperly preserved volatile organics.

Aqueous metals samples that were not nitric acid preserved to pH 2 in the field are laboratory preserved and held for twenty (24) hours to equilibrate prior to analysis. Aqueous metals samples requiring field filtration may be filtered in the laboratory within seventy-two (72) hours of receipt provided that the sample has not been acid preserved.

Unpreserved volatile organics samples may be analyzed within seven (7) days to minimize degradation of volatile organics if the laboratory is notified in advance of the failure to preserve upon collection. Laboratory preservation of unpreserved aqueous samples is not possible. A pH check of volatile organic samples prior to analysis will compromise the sample by allowing volatile organics to escape during the check. If the laboratory is not notified of the failure to field preserve an aqueous volatile organic sample, the defect will not be identified until sample analysis has been completed and the data is qualified accordingly.

9.5 ***Sample Tracking Via Status Change.*** An automated, electronic LIMS procedure records sample exchange transactions between departments and changes in analytical status. This system tracks all preparation, analytical, and data reporting procedures to which a sample is subjected while in the possession of the laboratory. Each individual receiving samples must acknowledge the change in custody and operational status in the LIMS. This step is required to maintain an accurate electronic record of sample status, dates of analytical activity, and custody throughout the laboratory.

Sample tracking is initiated at login where all chronological information related to sample collection dates and holding times are entered into the LIMS. This information is entered on an individual sample basis.

9.6 ***Sample Acceptance Policy***. Incoming samples must satisfy SGS Accutest Inc.'s sample acceptance criteria before being logged into the system. Sample acceptance is based on the premise that clients have exercised proper protocols for sample collection. This includes complete documentation, sufficient volume, proper chemical preservation, temperature preservation, sample container sealing and labeling, and appropriate shipping container packing.

The sample management staff will make every attempt to preserve improperly preserved samples upon arrival. However, if preservation is not possible, the samples may be refused unless the client authorizes analysis. No samples will be accepted if holding times have been exceeded or will be exceeded before analysis can take place unless the client authorizes analysis.

Sample acceptance criteria include proper custody and sample labeling documentation. Proper custody documentation includes an entry for all physical samples delivered to the laboratory with an identification code that matches the sample bottle and a date and signature of the individual who collected the sample and delivered them to the laboratory.

SGS Accutest Inc. reserves the right to refuse any sample which in its sole and absolute discretion and judgment is hazardous, toxic and poses or may pose a health, safety or environmental risk during handling or processing. The company will not accept samples for analysis using methodology that is not performed by the laboratory or for methods that lab does not hold valid accreditations unless arrangements have been made to have the analysis conducted by a qualified subcontractor.

SGS Accutest Inc. does not accept radioactive samples, however, the policy for sample handling of Naturally Occurring Radioactive Materials (NORM) is described below:

Samples that meet the Federal Department of Transportation and International Air Transportation Association criteria could be accepted and handled following normal procedures (except for disposal) in the lab. This corresponds to samples with United Nations

(UN) labels indicating levels of < 500 uR/hour. Samples containing levels at or higher than 500 uR/hour will not be accepted by SGS Accutest Inc. Clients must inform SGS Accutest Inc. of the level of radiation by screening the samples and documenting the level on the Chain of Custody or other form in order for the samples to be accepted.

SGS Accutest Inc. would require that any shipments containing samples of this type must be clearly labeled with UN labels showing the measured level of radioactivity as < 500 uR/hour.

These samples cannot be disposed of in our normal waste streams. Therefore, on completion of analysis, the samples would be returned to the client or disposed of using an alternate waste handler. In either case, the client would be responsible for the additional shipping or disposal charges, as well as processing charges for segregating the waste stream in the lab.

9.7 ***Assignment of Unique Sample Identification Codes***. Unique identification codes are assigned to each sample bottle to assure traceability and unambiguously identify the tests to be performed in the laboratory.

The sample identification coding process begins with the assignment of a unique alphanumeric job number. A job is defined as a group of samples received on the same day, from a specific client pertaining to a specific project. A job may consist of groups of samples received over a multi-day period. The first two characters of the job number are alpha-characters that identify the laboratory facility. The next characters are numeric and sequence by one number with each new job.

Unique sample numbers are assigned to each bottle collected as a discrete entity from a designated sample point. This number begins with the job number and incorporates a second series of numbers beginning at one and continuing chronologically for each point of collection. The test to be performed is clearly identified on the bottle label. Multiple sample bottles collected for analysis of the same parameter are numbered bottle 1, 2, etc.

Alpha suffixes may be added to the sample number to identify special designations such as subcontracted tests, in-house QC checks, or re-logs. Multiple sample bottles for a specific analysis are labeled Bottle 1, Bottle 2, etc.

9.8 ***Subcontracted Analysis***. Subcontract laboratories are employed to perform analysis not performed by SGS Accutest Inc. The quality assurance staff evaluates subcontract laboratories to assure their quality processes meet the standards of the environmental laboratory industry prior to engagement. Throughout the subcontract process, SGS Accutest Inc. follows established procedures to assure that sample custody is maintained and the data produced by the subcontractor meets established quality criteria.

*Subcontracting Procedure***.** Subcontracting procedures are initiated through several mechanisms, which originate with sample management. Samples for analysis by a subcontractor are logged into the SGS Accutest Inc. system using regular login procedures. If subcontract parameters are part of the project or sample management has received subcontracting instructions for a specific project, a copy of the chain of custody is given to the appropriate project manager with the subcontracted parameters highlighted. This procedure triggers the subcontract process at the project management level. The project manager contacts an approved subcontractor that carries accreditation in the venue of the project location to place the subcontract order. A subcontract order form (SOF) is simultaneously prepared in electronic format, by the project manager and filed with the original chain of custody. The SOF and the subcontract chain of custody are forwarded to sample management, via E-Mail, for processing. A copy is filed with the original CoC.

Sample management signs the subcontract chain of custody and ships the sample(s) to the subcontractor. The subcontract CoC is filed with the original CoC and the request for subcontract. Copies are distributed to the login department, the project manager, sample management and the client.

Clients are verbally notified of the need to subcontract analysis as soon as the need is identified by the client services staff. This may occur during the initial project setup or at the time of login if the project setup had not been initiated through the client services staff. Copies of the subcontract CoC and the original CoC, which are electronically distributed to clients, constitutes documented client notification of the laboratories intent to subcontract analysis.

Subcontractor data packages are reviewed by the QA Staff to assess completeness and quality compliance. If completeness defects are detected, the subcontractor is asked to immediately upgrade the data package. If data quality defects are detected, the QA staff retains the package for further review. The QA staff will pursue a corrective action solution before releasing defective data to the client.

Approved subcontract data is entered into the laboratory information management system (LIMS) if possible and incorporated into the final report. All subcontract data is footnoted to provide the client with a clear indication of its source. Copies of original subcontract data are included in the data report depending on the reporting level specified by the client. Applicable subcontractor accreditation information is provided with the subcontractor data.

*Subcontract Laboratory Evaluation***.** The QA staff evaluates subcontract laboratories prior to engagement. The subcontract laboratory must provide SGS Accutest Inc. with proof of a valid certification to perform the requested analysis for the venue where they were collected and for a specific program should an approval or accreditation be required. In addition, the QA staff may require a copy of the laboratory's Quality Systems Manual, copies of SOPs used for the subcontracted analysis, a copy of the most recent performance evaluation study for the subcontracted parameter, copies of the internal data integrity policy and copies of the most recent regulatory agency or third party accreditor audit report. Certification verification must be submitted to SGS Accutest Inc. annually. If possible, the QA staff may conduct a site visit to the laboratory to inspect the quality system. SGS Accutest Inc. assumes the responsibility for the performance of all subcontractors who have successfully demonstrated their qualifications and should obtain an example data deliverable package prior to initiation of subcontract work for compliance review. Qualification of a subcontract laboratory may be bypassed if the primary client directs SGS Accutest Inc. to employ a specific subcontractor.

9.9 ***Sample Storage***. Following sample transfer to the sample custodian, samples are assigned to various secured, refrigerated storage areas depending upon the test to be performed and the matrix of the samples. The location (refrigerator and shelf) of each sample is recorded on the chain of custody adjacent to the line corresponding to each sample number and also entered into the LIMS. Samples remain in storage until the laboratory technician requests that they be transferred into the laboratory for analysis.

Second shift staff is authorized to retrieve samples from storage and initiate custody transfer. All sample request forms must be completed regardless of who performs the transfer.

Samples for volatile organics analysis are placed in storage in designated refrigerators by the sample custodian and immediately transferred to the organics group control. Sample custody is transferred to the department designee. These samples are segregated according to matrix to limit opportunities for cross contamination to occur.

Organics staff is authorized to retrieve samples from these storage areas for analysis. When analysis is complete, the samples are placed back into storage.

9.10 ***Sample Login***. Following sample custody transfer to the laboratory, the documentation that describes the clients analytical requirements are delivered to the sample login group for coding and entry to the Laboratory Information Management System (LIMS). This process translates all information related to collection time, turnaround time, sample analysis, and deliverables into a code which enables client requirements to be electronically distributed to the various departments within the laboratory for scheduling and execution.

The technical staff is alerted to client or project specific requirements through the use of a unique project code that is electronically attached to the job during login. The unique project code directs the technical staff to controlled specifications documents detailing the unique requirements.

9.11 ***Sample Retrieval for Analysis***. Individual laboratory departments prepare and submit written requests to the sample custodian to retrieve samples for analysis. The sample custodian retrieves all samples except volatile organics and delivers them to the requesting department. Retrieval priorities are established by the requesting department and submitted to the sample custodian when multiple requests are submitted. Internal custody transfers using the bar code scanning system occur whenever the samples change hands or locations.
After sample analysis has been completed, the department requests pick-up and return of the sample to the storage area. The sample custodian retrieves the sample and completes the custody transfer from the department of the transfer back to sample management or sample storage.

9.12 ***Sample Disposal***. SGS Accutest Inc. retains all samples and sample extracts under proper storage for a minimum of 30 days following completion of the analysis report. Longer storage periods are accommodated on a client specific basis if required. Samples may also be returned to the client for disposal.
SGS Accutest Inc. disposes of all laboratory wastes following the requirements of the Resource Conservation and Recovery Act (RCRA). The Company has obtained and maintains a waste generator identification number, NJD982533622.

Sample management generates a sample disposal dump sheet from the LIMS tracking system each week, which lists all samples whose holding period has expired. Data from each sample is compared to the hazardous waste criteria established by the New Jersey Department of Environmental Protection (NJDEP).

Samples containing constituents at concentrations above the criteria are labeled as hazardous and segregated into five general waste categories for disposal as follows:

- Waste Oil
- Soil (solids – positive and negative hazardous characteristics)
- Mixed Aqueous
- Sludges (semi-solids)
- PCB Hazardous Waste (USEPA 40 CFR 761 criteria).

Non-hazardous aqueous samples are diluted and disposed directly into the laboratory sink. All aqueous liquids pass through a neutralization system before entering the municipal system. Solid samples are emptied into consolidation drums and disposed as hazardous waste or non-hazardous wastes depending upon the results of hazardous characteristics determination. Samples classified as PCB hazardous wastes are labeled and packaged according to the requirements in 40 CFR 761.

Empty glass and plastic bottles from aqueous and solid samples are segregated for recycling. Recycled materials are collected by a commercial contractor and transferred to a county transfer facility for separation into various materials categories. These operations are classified as secure facilities employing cameras, security guards and fiber optic security systems.
The recyclable material is transported to a recycling facility for further processing. Separated glass is transported to a processing facility where it is acid washed in two, separate wash baths, rinsed in boiling water and ground into ½ inch chunks. The chunks are transported to an end product user for re-manufacturing into a glass product.

Separated plastic is transported to a processing facility where it is acid washed to remove the labels and adhesives and boiled for sterilization. The sample containers and any remaining labels are shredded and ground resulting in complete destruction of remaining labels the ground material is sent by rail car or tractor-trailer to various end users that melt and reform the material into useful products of their industry. The recycling facility employs a Code of Ethics in which all client names are confidential and are not divulged to any individual or corporation without written permission from the client.

Laboratory wastes are collected by waste stream in designated areas throughout the laboratory. Waste streams are consolidated twice each week by the waste custodian and transferred to stream specific drums for disposal through a permitted waste management contractor. Filled, consolidated drums are tested for hazardous characteristics and scheduled for removal from the facility for appropriate disposal based on the laboratory data.

All solvent extracts and digestates are collected for disposal following the thirty-day holding period and drummed according to their specific waste stream category. Chlorinated solvent extracts are drummed as chlorinated wastes (i.e., Methylene Chloride). Non-chlorinated solvent extracts are drummed as non-chlorinated wastes (i.e., acetone, hexane, methanol, and mixed solvents). Digestates are collected for disposal following the thirty-day holding period and drummed as corrosive liquid containing metals.

10.0 LABORATORY INSTRUMENTATION AND MEASUREMENT STANDARDS

Requirement: The laboratory has established procedures, which assure that instrumentation is performing to a pre-determined operational standard prior to the analysis of any samples. In general, these procedures follow the regulatory agency requirements established in promulgated methodology. The instrumentation selected to perform specified analysis are uniquely identified and capable of providing the method specified uncertainty of measurement needed. These procedures are documented and incorporated into the standard operating procedures for the method being executed.

10.1 ***Mass Tuning – Mass Spectrometers***. The mass spectrometer tune and sensitivity is monitored to assure that the instrument is assigning masses and mass abundances correctly and that the instrument has sufficient sensitivity to detect compounds at low concentrations. This is accomplished by analyzing a specific mass tuning compound at a fixed concentration. If the sensitivity is insufficient to detect the tuning compound, corrective action must be performed prior to the analysis of standards or samples. If the mass assignments or mass abundances do not meet criteria, corrective action must be performed prior to the analysis of standards or samples.

10.2 ***Wavelength Verification – Spectrophotometers***. Spectrophotometer detectors are checked on a regular schedule to verify proper response to the wavelength of light needed for the test in use. If the detector response does not meet specifications, corrective action (detector adjustment or replacement) is performed prior to the analysis of standards or samples.

10.3 ***Inter-element Interference Checks (Metals)***. Inductively Coupled Plasma Emission Spectrophotometers (ICP) are subject to a variety of spectral interferences, which can be minimized or eliminated by applying interfering element correction factors and background correction points. Interfering element correction factors are checked on a specified frequency through the analysis of check samples containing high levels of interfering elements. Analysis of single element interferant solutions is also conducted at a specified frequency.

If the check indicates that the method criteria have not been achieved for any element in the check standard, the analysis is halted and data from the affected samples are not reported. Sample analysis is resumed after corrective action has been performed and the correction factors have been re-calculated.

New interfering element correction factors are calculated and applied whenever the checks indicate that the correction factors are no longer meeting criteria. At a minimum, correction factors are replaced once a year.

Inductively Coupled Plasma – Mass Spectrometry (ICP-MS) also is subject to isobaric elemental and polyatomic ion interferences. These interferences are corrected through the use of calculations. The accuracy of corrections is dependent on the sample matrix and instrument conditions and is verified by quality control checks on individual runs.

10.4 ***Calibration and Calibration Verification***. Many tests require calibration using a series of reference standards to establish the concentration range for performing quantitative analysis. Instrument calibration is performed using standards that are traceable to national standards. Method specific procedures for calibration are followed prior to any sample analysis. In general, if a reference method does not specify the number of calibration standards, the minimum number is two (one of which is at the reporting limit or limit of quantitation).

Calibration is performed using a linear regression calculation or calibration factors calculated from the curve. The calibration must meet method specific criteria for linearity or precision. If the criteria are not achieved, corrective action (re-calibration or instrument maintenance) is performed. The instrument must be successfully calibrated before analysis of samples can be conducted.

Initial calibration for metals analysis performed using inductively coupled plasma (ICP) employs the use of a single standard and a calibration blank to establish linearity. Inductively Coupled Plasma – Mass Spectrometry (ICP-MS) can be calibrated using either a two point or a multi-point calibration, as long as all quality control criteria for the analysis can be achieved. The calibration blank contains all reagents that are placed into the calibration standard with the exception of the target elements. Valid calibration blanks must not contain any target elements.

Initial calibrations must be verified using a single concentration calibration standard from a second source (i.e. separate lot or different provider). The continuing validity of existing calibrations must be regularly verified using a single calibration standard. The response to the standard must meet pre-established criteria that indicate the initial calibration curve remains valid. If the criteria are not achieved corrective action (re-calibration) is performed before any additional samples may be analyzed.

If continuing calibration verification results are outside established criteria, data associated with the verification may be fully useable under the following conditions:

- When the acceptance criteria for the continuing calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported.

- When the acceptance criteria for the continuing calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level.

Calibration verification is also performed whenever it appears that the analytical system is out of calibration or no longer meets the calibration requirements. It is also performed when the time period between calibration verifications has expired.

Sample results are quantitated from the initial instrument calibration unless otherwise required by regulation, method, or program specific criteria.

10.5 ***Linear Range Verification and Calibration (ICP & ICP/MS Metals)***. Linear range verification is performed for all ICP and ICP/MS instrumentation. The regulatory program or analytical method specifies the verification frequency. A series of calibration standards are analyzed over a broad concentration range. The data from these analyses are used to determine the valid analytical range for the instrument. ICP instrument calibration is routinely performed using a single standard at a concentration within the linear range and a blank.

Some methods or analytical programs require a low concentration calibration check to verify that instrument sensitivity is sufficient to detect target elements at the reporting limit. The analytical method or regulatory program defines the criteria used to evaluate the low concentration calibration check. If the low calibration check fails criteria, corrective action is performed and verified through reanalysis of the low concentration calibration check before continuing with the field sample analysis. . ICP-MS instrument calibration is normally performed using multiple standards within the linear range and a blank, but may be done with a single standard at a concentration within the linear range and a blank.

10.6 ***Retention Time Development and Verification (GC)***. Chromatographic retention time windows are developed for all analysis performed using gas chromatographs with conventional detectors. An initial experimental study is performed, which establishes the width of the retention window for each compound. The retention time width of the window defines the time ranges for elution of specified target analytes on the primary and confirmation columns. Retention time windows are established upon initial calibration, applying the retention time range from the initial study to each target compound. Retention times are regularly confirmed through the analysis of an authentic standard during calibration verification. If the target analytes do not elute within the defined range during calibration verification, the instrument must be recalibrated and new windows defined. New studies are performed when major changes, such as column replacement are made to the chromatographic system.

10.7 ***Equipment List.*** See Appendix IV for a listing of all equipment used for measurement and/or calibration in laboratory processes.

11.0 INSTRUMENT MAINTENANCE

Requirement. Documented procedures have been established for conducting equipment maintenance. The procedure includes maintenance schedules if required or documentation of daily maintenance activities. All instrument maintenance activities are documented in instrument specific logbooks.

11.1 ***Routine, Daily Maintenance***. Routine, daily maintenance is required on an instrument specific basis and is performed each time the instrument is used. Daily maintenance includes activities to insure a continuation of good analytical performance. This may include performance checks that indicate if non-routine maintenance is needed. If performance checks indicate the need for higher level maintenance, the equipment is taken out of service until maintenance is performed. Analysis cannot be continued until all performance checks meet established criteria and a return to operational control has been demonstrated and documented. The individual assigned to the instrument is responsible for daily maintenance.

11.2 ***Non-routine Maintenance***. Non-routine maintenance is initiated for catastrophic occurrences such as instrument failure. The need for non-routine maintenance is indicated by failures in general operating systems that result in an inability to conduct required performance checks or calibration. Equipment in this category is taken out of service, tagged accordingly and repaired before attempting further analysis. Before initiating repairs, all safety procedures for safe handling of equipment during maintenance, such as lock-out/tag-out are followed. Analysis is not resumed until the instrument meets all operational performance check criteria, is capable of being calibrated and a return to operational control has been demonstrated and documented. Section supervisors are responsible for identifying non-routine maintenance episodes and initiating repair activities to bring the equipment on-line. This may include initiating telephone calls to maintenance contractors if necessary. They are responsible for documenting all details related to the occurrence and repair.

11.3 ***Scheduled Maintenance***. Modern laboratory instrumentation rarely requires regular preventative maintenance. If required, the equipment is placed on a schedule, which dictates when maintenance is needed. Examples include annual balance calibration by an independent provider or ICP preventative maintenance performed by the instrument manufacturer. Section supervisors are responsible for initiating scheduled maintenance on equipment in this category. Scheduled maintenance is documented using routine documentation practices.

11.4 ***Maintenance Documentation***. Routine and non-routine maintenance activities are documented in logbooks assigned to instruments and equipment used for analytical measurements. The logbooks contain preprinted forms, which specify the required maintenance activities. The analyst or supervisor performing or initiating the maintenance activity is required to check the activity upon its completion and initial the form. This includes documenting that the instrument has been returned to operational control following the completion of the activity. Non-routine maintenance (repairs, upgrades) is documented on the back page of the service log.

12.0 QUALITY CONTROL PARAMETERS, PROCEDURES, AND CORRECTIVE ACTION

Requirement: All procedures used for test methods incorporate quality control parameters to monitor elements that are critical to method performance. Each quality parameter includes acceptance criteria that have been established by regulatory agencies for the methods in use. Criteria may also be established through client dictates or through the accumulation and statistical evaluation of internal performance data. Data obtained for these parameters during routine analysis must be evaluated by the analyst, and compared to the method criteria in use. If the criteria are not achieved, the procedures must specify corrective action and conformation of control before proceeding with sample analysis. QC parameters, procedures, and corrective action must be documented within the standard operating procedures for each method. In the absence of client specific objectives the laboratory must define qualitative objectives for completeness and representativeness of data.

12.1 ***Procedure***. Bench analysts are responsible for methodological quality control and sample specific quality control. Each method specifies the control parameters to be employed for the method in use and the specific procedures for incorporating them into the analysis. These control parameters are analyzed and evaluated with every designated sample group (batch).

The data from each parameter provides the analyst with critical decision making information on method performance. The information is used to determine if corrective action is needed to bring the method or the analysis of a specific sample into compliance. These evaluations are conducted throughout the course of the analysis. Each control parameter is indicative of a critical control feature. Failure of a methodological control parameter is indicative of either instrument or batch failure. Failure of a sample control parameter is indicative of control difficulties with a specific sample or samples.

Sample Batch. All samples analyzed in the laboratory are assigned to a designated sample batch, which contains all required quality control samples and a defined maximum number of field samples that are prepared and/or analyzed over a defined time period. The maximum number of field samples in the batch is 20. SGS Accutest Inc. has incorporated the TNI Standard batching policy as the sample-batching standard. This policy incorporates the requirement for blanks and spiked blanks as a time based function as defined by TNI Standard. Accordingly, the specified time period for a sample batch is 24 hours. Matrix spike/matrix spike duplicate, matrix spikes and duplicates are defined as sample frequency based functions and may be applied to several batches until the frequency requirement has been reached. A matrix spike/matrix spike duplicate, matrix spikes and/or duplicate is required every 20 samples.

Client criteria that defines a batch as a time based function which includes a matrix spike/matrix spike duplicates as a contractual specification will be honored. The typical batch contains a blank and a laboratory control sample (LCS or spiked blank). Batch documentation includes lot specifications for all reagents and standards used during preparation of the batch.

12.2 ***Methodological Control Parameters and Corrective Action***. Prior to the analysis of field samples the analyst must determine that the method is functioning properly. Specific control parameters indicate whether critical processes meet specified requirements before continuing with the analysis. Method specific control parameters must meet criteria before sample analysis can be conducted. Each of these parameters is related to processes that are under the control of the laboratory and can be adjusted if out of control.

Method Blank. A method blank is analyzed during the analysis of any field sample. The method blank is defined as a sample. It contains the same standards (internal standards, surrogates, matrix modifiers, etc.) and reagents that are added to the field sample during analysis, with the exception of the sample itself. If the method blank contains target analytes(s) at concentrations that exceed method detection limit concentrations (organics) or reporting limit concentrations (inorganics), the source of contamination is investigated and eliminated before proceeding with sample analysis. Target analyte(s) in method blanks at concentrations no greater than one-half of the reporting limit concentrations (metals) may be requested on a client or project specific basis. Systematic contamination is documented for corrective action and resolved following the established corrective action procedures.

Laboratory Control Samples (LCS or Spiked Blanks). A laboratory control sample (spiked blank or commercially prepared performance evaluation sample) is analyzed along with field samples to demonstrate that method accuracy is within acceptable limits. These spike solutions may be from different sources than the sources of the solutions used for method calibration depending upon the method requirements. All target components are included in the spike mixture over a two year period. The performance limits are derived from published method specifications or from statistical data generated from the analysis of laboratory method performance samples. Spiked blanks are blank matrices (reagent water or clean sand) spiked with target parameters and analyzed using the same methods used for samples. Accuracy data is compared to laboratory derived limits to determine if the method is in control. Laboratory control samples (LCS) are commercially prepared spiked samples in an inert matrix. Performance criteria for recovery of spiked analytes are pre-established by the commercial entity preparing the sample. The sample is analyzed in the laboratory as an external reference.

Accuracy data is compared to the applicable performance limits. If the spike accuracy exceeds the performance limits, corrective action, as specified in the SOP for the method is performed and verified before continuing with a field sample analysis. In some cases, decisions are made to continue with sample analysis if performance limits are exceeded, provided the unacceptable result has no negative impact on the sample data.

Blanks and spikes are routinely evaluated before samples are analyzed. However, in situations where sample analysis is performed using an auto sampler, they may be evaluated after sample analysis has occurred. If the blanks and spikes do not meet criteria, sample analysis is repeated.

Proficiency Testing. Proficiency test samples (PTs) are single or double blind spikes, introduced to the laboratory to assess method performance. PTs may be introduced as double blinds submitted by commercial clients, single or double blinds from regulatory agencies, or internal blinds submitted by the QA group.

A minimum of two single blind studies must be performed each year for every parameter in aqueous and solid matrices for each field of testing for which the laboratory maintains accreditation. Proficiency samples must be purchased as blinds from an A2LA accredited vendor. Data from these studies are provided to the laboratory by the vendor and reported to accrediting agencies. If unsatisfactory performance is noted, corrective action is performed to identify and eliminate any sources of error. A new single blind must be analyzed if required to demonstrate continuing proficiency.

PT samples performed for accrediting agencies or clients, which do not meet performance specifications, require a written summary that documents the corrective action investigation, findings, and corrective action implementation. A copy of this summary shall be submitted to the TNI Standard Primary Accrediting Authority, NJDEP Office of Quality Assurance for review.

Single or double blind proficiency test samples may be employed for self-evaluation purposes. Data from these analyses are compared to established performance limits. If the data does not meet performance specifications, the system is evaluated for sources of acute or systematic error. If required, corrective action is performed and verified before initiating or continuing sample analysis.

Trend Analysis for Control Parameters. The quality assurance staff is responsible for continuous analytical improvement through quality control data trend analysis. Accuracy data for spiked parameters in the spiked blank are statistically evaluated weekly for trends indicative of systematic problems. Data from LCS parameters and surrogates are pooled on a method, matrix, and instrument basis. This data is evaluated by comparison to existing control and warning limits. Trend analysis is performed automatically as follows:

- Any point outside the control limit
- Any three consecutive points between the warning and control limits
- Any eight consecutive points on the same side of the mean.
- Any six consecutive points increasing or decreasing

The results of the trend analysis are transmitted as .PDF files for supervisory evaluation prior to sample analysis. Trends that indicate the potential loss of statistical control are further evaluated to determine the impact on data quality and to determine if corrective action is necessary. If corrective action is indicated, the supervisor informs the analysts of the corrective actions to be performed. Return to control is demonstrated before analysis resumes.

12.3 ***Sample Control Parameters and Corrective Action***. The analysis of samples can be initiated following a successful demonstration that the method is operating within established controls. Additional controls are incorporated into the analysis of each sample to determine if the method is functioning within established specifications for each individual sample. Sample

QC data is evaluated and compared to established performance criteria. If the criteria are not achieved the method or the SOP specifies the corrective action required to continue sample analysis. In many cases, failure to meet QC criteria is a function of sample matrix and cannot be remedied. Each parameter is designed to provide quality feedback on a defined aspect of the sampling and analysis episode.

Duplicates. Duplicate sample analysis is used to measure analytical precision. This can also be equated to laboratory precision for homogenous samples. Precision criteria are method dependent. If precision criteria are not achieved, corrective action or additional action may be required. Recommended action must be completed before sample data can be reported.

Laboratory Spikes & Spiked Duplicates. Spikes and spiked duplicates are used to measure analytical precision and accuracy for the sample matrix selected. Precision and accuracy criteria are method dependent. If precision and accuracy criteria are not achieved, corrective action or additional action may be required. Recommended action must be completed before reporting sample data. All target components are included in the spike mixture over a two year period.

Serial Dilution (Metals). Serial dilutions of metals samples are analyzed to determine if analytical matrix effects may have impacted the reported data. If the value of the serially diluted samples does not agree with the undiluted value within a method-specified range, the sample matrix may be causing interferences, which may lead to either a high or low bias. If the serial dilution criterion is not achieved, it must be flagged to indicate possible bias from matrix effects.

Post Digestion Spikes. Digested samples are spiked and analyzed to determine if matrix interferences are biasing the results when the pre-digestion spike (matrix spike) recovery falls outside the control limits. It may also be used to determine potential interferences per client's specification. The sample is spiked at the concentration specified in the method SOP. No action is necessary if the post digestion spike is outside of the method criteria, unless a preparation problem is suspected with the spike, in which case the post digestion spike should be re-prepared and reanalyzed.

Surrogate Spikes (Organics). Surrogate spikes are organic compounds that are similar in behavior to the target analytes but unlikely to be found in nature. They are added to all quality control and field samples to measure method performance for each individual sample. Surrogate accuracy limits are derived from published method specifications or from the statistical evaluation of laboratory generated surrogate accuracy data. Accuracy data is compared to the applicable performance limits. If the surrogate accuracy exceeds performance limits, corrective action, as specified in the method or SOP is performed before sample data can be reported.

Internal Standards (Organic Methods). Internal standards are retention time and instrument response markers added to every sample to be used as references for quantitation. Their response is compared to reference standards and used to evaluate instrument sensitivity on a sample specific basis. Internal standard retention time is also compared to reference standards to assure that target analytes are capable of being located by their individual relative retention time.

If internal standard response criteria are not achieved, corrective action or additional action may be required. The recommended action must be completed before sample data can be reported.

If the internal standard retention time criteria are not achieved corrective action or additional action may be required. This may include re-calibration and re-analysis. Additional action must be completed before sample data is reported.

Internal Standards (ICP and ICP/MS Metals). Internal standards are used on ICP instruments to compensate for variations in response caused by differences in sample matrices. Multiple internal standards are used for each sample on ICP/MS instruments to compensate for variations in response caused by differences in sample matrices. This adjustment is performed automatically during sample analysis. The internal standard response of replicated sample analysis is monitored to detect potential analytical problems. If analytical problems are suspected, then the field samples may be reanalyzed or reanalyzed upon dilution to minimize the interferences. A different internal standard may be employed for quantitation in situations where the field sample contains the element typically used as the internal standard.

12.4 ***Laboratory Derived Quality Control Criteria.*** Control criteria for in-house methods and client specific modifications that exceed the scope of published methodology are defined and documented prior to the use of the method. The Quality Assurance Director is responsible for identifying additional control criteria needs. Control parameters and criteria, based on best technical judgment are established using input provided by the operations staff. These control parameters and criteria are documented and incorporated into the method.

The laboratory-derived criteria are evaluated for technical soundness on spiked samples prior to the use of the method on field samples. The technical evaluation is documented and archived by the Quality Assurance Staff.

When sufficient data from the laboratory developed control parameter is accumulated, the data is statistically processed and the experimentally derived control limits are incorporated into the method.

12.5 ***Bench Review & Corrective Action***. The bench chemists are responsible for all QC parameters. Before proceeding with sample analysis, they are required to successfully meet all instrumental QC criteria. They have the authority to perform any necessary corrective action before proceeding with sample analysis. Their authority includes the responsibility for assuring that departures from documented policies and procedures do not occur.

The bench chemists are also responsible for all sample QC parameters. If the sample QC criteria are not achieved, they are authorized and required to perform the method specified corrective action before reporting sample data.

12.6 ***Data Qualifiers*.** An alpha character coding system is employed for defining use limitations for reported data. These limitations are applied to analytical data by the analyst to clarify the usefulness of the reported data for data user. Common data qualifiers and their definitions are as follows:

Organics.

J: Indicates an estimated value. Applied to calculated concentrations for tentatively identified compounds and qualitatively identified compounds whose concentration is below the reporting limit, but above the MDL.

N: Indicates qualitative evidence of a tentatively identified compound whose identification is based on a mass spectral library search and is applied to all TIC results.

C: Applied to pesticide data that has been qualitatively confirmed by GC/MS.

B: Used for analytes detected in the sample and its associated method blank.

E: Applied to compounds whose concentration exceeds the upper limit of the calibration range.

Metals and Inorganics.

B: Applied if the reported concentration value was less than the reporting limit but greater than the MDL.

U: Applied if the reading is less than the MDL (or IDL if IDL reporting is being used).

E: Estimated concentration caused by the presence of interferences, normally applied when the serial dilution is out.

N: Spike sample recovery not within control limits.

*: Duplicate or matrix spike duplicate analysis not within control limits.

12.7 ***Data Package Review***. SGS Accutest Inc. employs at least two levels of data review, the final review must be performed by a manager, supervisor or designated reviewer, to assure that reported data has satisfied all quality control criteria and that client specifications and requirements have been met. Each production department has developed specific data review procedures, which must be completed before data is released to the client.

Analytical Review. The analyst conducts the primary review of all data. This review begins with a check of all instrument and method quality control and progresses through sample quality control, concluding with a check to assure that the client's requirements have been executed. Analyst checks focus on a review of qualitative determinations and checks of precision and accuracy data to verify that existing laboratory criteria have been achieved.

Checks at this level may include comparisons with project specific criteria if applicable. The analyst has the authority and responsibility to perform corrective action for any out-of-control parameter or nonconformance at this stage of review.

Analysts who have met the qualification criteria for the method in use perform secondary, peer level data reviews. Analyst qualification requirements include a valid demonstration of capability and demonstrated understanding of the method SOP. Section supervisors may perform secondary review in-lieu of a peer review. Managers, Supervisors or designated reviewers evaluate 100% of the data produced by their department. It includes a check of all manual calculations; an accuracy check of manually transcribed data from bench sheets to the LIMS, a check of calibration and continuing calibration, all QC criteria and a comparison of the data package to client specified requirements. Also included are checks to assure the appropriate methodology was applied and that all anomalous information was properly flagged for communication in the case narrative. Supervisors have the authority to reject data and initiate re-analysis, corrective action, or reprocessing.

All laboratory data requiring manual entry into LIMS system is double-checked by the analysts performing initial data entry and the section supervisor. Verification of supervisory review is indicated on the raw data summary by the manager, supervisor, or designated reviewer's initials and date.

Electronic data that is manually edited at the bench by the primary analyst is automatically flagged by the instrument data system indicating an override by the analyst. All manual overrides must be verified and approved by a supervisor who initials and dates all manual changes.

Hard copies (or PDF's) of manually integrated chromatographic peaks are printed that clearly depict the manually drawn baseline. The hard copy (or PDF) is reviewed and approved by the section manager, supervisor or designated reviewer (initialed and dated) and included in the data package of all full tier reports or the archived batch records of commercial report packages.

Edits to electronic data that have already been committed to the LIMS database are controlled through the use of the Master Edit function in LIMS. Permission to access this program is limited to those approved by the upper levels of laboratory management and is controlled by the Information Technology staff. A GALP electronic audit record trail is maintained for all changes that are made and is automatically appended to the record.

The group manager performs a tertiary review on a spot check basis. This review includes an evaluation of QC data against acceptance criteria and a check of the data package contents to assure that all analytical requirements and specifications were executed.

Report Generation Review. The report generation group reviews all data and supporting information delivered by the laboratory for completeness and compliance with client specifications. Missing deliverables are identified and obtained from the laboratory. The group also reviews the completed package to verify that the delivered product complies with all client specifications. Non-analytical defects are corrected before the package is sent to the client.

Project Management/Quality Control Review. Spot-check data package reviews are performed by the project management staff. Project management reviews focus on project specifications. If the project manager identifies defects in the product prior to release, he initiates immediate corrective action to rectify the situation.

The QA staff performs a post-delivery check of completed data packages to verify completeness and compliance with established quality control procedures. Approximately 10% of Full-Deliverables data packages are reviewed. A formal checklist is used to assess data report completeness and accuracy. Detected deficiencies are documented on the checklist and corrective actions initiated as necessary. Data review checklists are electronic documents, which are archived in the QA Directory of the network server.

The QA review focuses on all elements of the deliverable including the client's specifications and requirements, analytical quality control, sample custody documentation and sample identification. QA reviews at this step in the production process are geared towards systematic process defects, which require procedural changes to effect a corrective action. However, if defects are identified that have an adverse effect on data, the client is immediately informed following standard notification procedures. QA data review is not used in lieu of a peer level review or a supervisory review.

Data Reporting. Analytical data is released to clients following a secondary review by the manager, supervisor or designated reviewer. Data release at this stage of the process is limited to electronic information, which is released to clients through a secure, encrypted, password protected, Internet connection. Hard copy support data is compiled by the report generation group and assembled into the final report. The report is sent to the client following reviews by the report generation staff.

All data reports include specified information, which is required to identify the report and its contents. This information includes a title, name and address of the laboratory, a unique report number, total number of pages in the report, clients name and address, analytical method identification, arriving sample condition, sample and analysis dates, test results with units of measurement, authorized signature of data release, statement of applicability, report reproduction restrictions and TNI Standard requirements certification. Data reports for the Department of Defense ELAP also include the time of preparation and analysis.

12.8 ***Electronic Data Reduction.*** Raw data from sample analysis is entered into the laboratory information management system (LIMS) using automated processes or manual entry. Final data processing is performed by the LIMS using procedures developed by the Company.

All LIMS programs are tested and validated prior to use to assure that they consistently produce correct results. The Information Technology Staff performs software validation testing. The testing procedures are documented in an SOP. Software programs are not approved for use until they have demonstrated that they are capable of performing the required calculations.

12.9 ***Representativeness***. Data representativeness is based on the premise that qualitative and quantitative information developed for field samples is characteristic of the sample that was collected by the client and analyzed in the laboratory. The laboratory objective for representativeness defines data as representative if the criteria for all quality parameters associated with the analysis of the sample are achieved.

12.10 ***Comparability***. Analytical data is defined as comparable when data from a sample set analyzed by the laboratory is representatively equivalent to other sample sets analyzed separately regardless of the analytical logistics. The laboratory will achieve 100% comparability for all sample data which meets the criteria for the quality parameters associated with its analysis using the method requested by the client.

13.0 CORRECTIVE ACTION SYSTEM

Requirement. The laboratory employs policies and procedures for correcting defective processes, systematic errors, and quality defects enabling the staff to systematically improve product quality. The system includes procedures for communicating items requiring corrective action to responsible individuals, corrective action tracking procedures, corrective action documentation, monitoring of effectiveness, and reports to management. The system is fully documented in a standard operating procedure. Individual corrective actions and responses are documented in a dedicated database.

13.1 ***Procedure***. Corrective action is the step that follows the identification of a process defect. The type of defect determines the level of documentation, communication, and training necessary to prevent re-occurrence of the defect or non-conformance. The formal system is maintained by the quality assurance department. Operations management is responsible for working within the system to resolve identified deficiencies.

Routine Corrective Action. Routine corrective action is defined as the procedures used to return out of control analytical systems back to control. This level of corrective action applies to all analytical quality control parameters or analytical system specifications.

Bench analysts have full responsibility and authority for performing routine corrective action. The resolution of defects at this level does not require a procedural change or staff re-training. The analyst is free to continue work once corrective action is complete and the analytical system has been returned to control. Documentation of routine corrective actions is limited to logbook comments for the analysis being performed.

Process Changes. Corrective actions in this category require procedural modifications. They may be the result of systematic defects identified during audits, the investigation of client inquiries, failed proficiency tests, product defects identified during data review, or method updates. Resolution of defects of this magnitude requires formal identification of the defect, development and documentation of a corrective action plan, and staff training to communicate the procedural change.

Technical Corrective Action. Technical corrective action encompasses routine corrective action performed by bench analysts for out of control systems and corrective actions performed for data produced using out of control systems. Technical corrective action for routine situations is conducted using the procedures detailed above.

Non-routine corrective actions apply to situations where the bench analysts failed to perform routine corrective action before continuing analysis. Supervisors and Department Managers perform corrective action in these situations. Documentation of all non-routine corrective actions is performed using the corrective action system.

Sample re-analysis is conducted if sufficient sample and holding time remain to repeat the analysis using an in-control system. If insufficient sample or holding time remains, the data is processed and qualifiers applied that describe the out of control situation. The occurrence is further documented in the case narrative and in the corrective action response. The corrective action must include provisions for retraining the analysts who failed to perform routine corrective action.

13.2 ***Documentation & Communication***. Routine corrective actions are documented as part of the analytical record. Notations are made in the comments section of the analytical chronicle or data sheet detailing the nonconformance and corrective action. Continuation of the analysis indicates that return to control was successful.

Corrective actions for process changes are documented, tracked and monitored for effectiveness. Supervisors or senior staff members may initiate corrective actions by generating a corrective action using the corrective action database application.

The corrective action database is an Access application. The initiator generates the corrective action investigation form, which is documented, tracked, distributed to responsible parties and archived through the application. The application assigns a tracking number, initiation data and due date to each action and copies the corrective action form to the database. E-mail message containing the form is automatically distributed to the responsible parties for resolution.

The responsible party identifies the root cause of the defect, initiates the immediate fix and develops and implements the procedural change. Existing documentation such as SOPs are edited to reflect the change. The affected staff is informed of the procedural change through a formal training session. The training is documented and copies are placed into individual training files. The corrective action form is completed by the responsible party and returned to the QA staff via e-mail using the database application.

Initial and completed corrective action forms are maintained in the corrective action database. This entire database is backed up and archived daily. The corrective action tracking form is maintained as an active report in the database.

Monitoring. The QA Staff monitors the implemented corrective action until it is evident that the action has been effective and the defect has been eliminated. The corrective action database is updated by QA to reflect closure of the corrective action. The QA staff assigns an error code to the corrective action for classification of the type of errors being committed. Additional monitoring of the corrective action is conducted during routine laboratory audits.

Additional monitoring of the corrective action is conducted by adding the corrective action to a verification list by the QA staff at closure. Verification is performed by the QA Staff to assure that the corrective action has remained in effect is scheduled for six (6) months from the initial closure date.

If QA determines that the corrective action response has not effectively remedied the deficiency, the process continues with a re-initiation of the corrective action. Corrective action continues until the defect is eliminated. If another procedural change is required, it is treated as a new corrective action, which is documented and monitored using established procedures.

Client Notification. Defective processes, systematic errors, and quality defects, detected during routine audits may have negative impacts on data quality. In some cases, data that has been released to clients may be affected. If defective data has been released for use, SGS Accutest Inc. will notify the affected clients of the defect and provide specific details regarding the magnitude of the impact to their data.

14.0 PROCEDURES FOR EXECUTING CLIENT SPECIFICATIONS

Requirement. Systems have been established for evaluating and processing client specifications for routine and non-routine analytical services. The systems enable the client services staff to identify, evaluate, and document the requested specifications to determine if adequate resources are available to perform the analysis. The system includes procedures for communicating the specifications to the laboratory staff for execution and procedures for verifying the specifications have been executed.

14.1 ***Client Specific Requirements***. The project manager is the primary contact for clients requesting laboratory services. Client specifications are communicated using several mechanisms. The primary sources of information are the client's quality assurance project plan (QAPjP) and the analytical services contract both of which detail the analytical, quality control and data reporting specifications for the project. In the absence of a QAPjP, projects specifications can also be communicated using contracts, letters of authorization, or letters of agreement, which may be limited to a brief discussion of the analytical requirements and the terms and conditions for the work. These documents may also include pricing information, liabilities and scope of work, in addition to the analytical requirements. QAPjPs include detailed analytical requirements and data quality objectives, which supersede those found in the referenced methods. This information is essential to successful project completion.

The client services staff provides additional assistance to clients who are unsure of the specifications they need to execute the sampling and analysis requirements of their project. They provide additional support to clients who require assistance in results interpretation as needed, provided they possess the expertise required to render an opinion.

The project manager is responsible for obtaining project documents, which specify the analytical requirements. Following project management review, copies are distributed to the QA Director and the appropriate departmental managers for review and comment. The original QAPjP is filed in a secure location.

14.2 ***Requirements for Non-Standard Analytical Specifications***. Client requirements that specify departures from documented policies, procedures, or standard specifications must be submitted to SGS Accutest Inc. in writing. These requirements are reviewed and approved by the technical staff before the project is accepted. Once accepted, the non-standard requirements become analytical specifications, which follow the routine procedure for communicating client specifications. Departures from documented policies, procedures, or standard specifications that do not follow this procedure are not permitted.

14.3 ***Evaluation of Resources.*** A resource evaluation is completed prior to accepting projects submitted by clients. The evaluation is initiated by the client services staff who prepares a brief synopsis that includes the logistical requirements of the project. Logistical specifications for new projects are summarized in writing for evaluation by the affected departments. The specifications are evaluated by the department manager from a scheduling and hardware resources perspective. The project is not accepted unless the department managers have the necessary resources to execute the project according to client specifications.

14.4 ***Documentation***. New projects are initiated using LIMS or a project set up form, which is completed prior to the start of the project. This form details all of the information needed to correctly enter the specifications for each client sample into the laboratory information management system (LIMS). The form includes data reporting requirements, billing information, data turnaround times, QA level, state of origin, and comments for detailing project specific requirements. The project manager is responsible for obtaining this information from the client and completing the form prior to sample arrival and login.

Sample receipt triggers project creation and the login process. The information on the set-up form is entered into the LIMS immediately prior to logging in the first sample. The set up form may be accompanied by a quotation, which details the analytical product codes and sample matrices. These details are also entered into the LIMS during login.

Special information is distributed to the laboratory supervisors and login department in electronic or hardcopy format upon project setup. All, project specific information is retained by the project manager in a secure file. The project manager maintains a personal telephone log, which details conversations with the client regarding the project.

Department managers prepare summary sheets that detail client specific analytical requirements for each test. Bench analysts use these sheets to obtain information regarding client specific analytical requirements before analyzing samples. A program code is established for each client that links the client specifications to a client project. This code is attached to a project by the project manager at login and listed on the work list for each work group conducting analysis for clients with standing requirements.

14.5 ***Communication***. A pre-project meeting is held between client services and the operations managers to discuss the specifications described in the QAPjP, contract and/or related documents. Project logistics are discussed and finalized and procedures are developed to assure proper execution of the client's analytical specifications and requirements. Questions, raised in the review meeting, are discussed with the client for resolution. Exceptions to any requirements, if accepted by the client, are documented and incorporated into the QAPjP or project documentation records.

Non-standard specifications for individual clients are documented in the LIMS at the client account level or program level. Simple specifications are documented as comments for each project. Once entered into the LIMS, these specifications become memorialized for all projects related to the client account. Complex specifications are assigned program codes that link the specification to detailed analytical specifications.

Upon sample arrival, these specifications are accessed through a terminal or printed as a hard copy and stored in a binder for individuals who require access to the specification. Specifications that are not entered into the LIMS are prohibited unless documented in an interdepartmental memo, which clearly identifies the project, client and effective duration of the specification.

14.6 ***Operational Execution***. A work schedule is prepared for each analytical department on a daily basis. Analytical specifications or program codes from recently arrived samples have now been entered into the LIMS database. The database is sorted by analytical due date and holding time, into product specific groups. Samples are scheduled for analysis by due date and holding time. The completed schedule, which is now defined as a work list, is printed. The list contains the client requested product codes, program codes and specifications required for the selected sample(s). Special requirements are communicated to the analyst using the comments section or relayed through verbal instructions provided by the supervisor. The bench analyst assumes full responsibility for performing the analysis according to the specifications printed on the work sheet.

14.7 ***Verification***. Prior to the release of data to the client, the report generation staff review the report and compare the completed product to the client specifications documentation to assure that all requirements have been met. Project managers perform a spot check of projects with unique requirements to assure that the work was executed according to specifications.

15.0 CLIENT COMPLAINT RESOLUTION PROCEDURE

Requirement. The laboratory follows a formal system for managing and reconciling client complaints. The system includes procedures for documenting the complaint and communicating it to the appropriate department for resolution. The system also includes a quality assurance evaluation to determine if the complaint is related to systematic defects requiring corrective action and process changes.

15.1 ***Procedure***. Client complaints are communicated to client services representatives, quality assurance staff, or senior management staff for resolution. The individual receiving the complaint retains the responsibility for documentation and communicating the nature of the complaint to the responsible department(s) for resolution. The responsible party addresses the complaint. The resolution is communicated to quality assurance (QA) and the originator for communication to the client. QA reviews the complaint and resolution to determine if systematic defects exist. If systematic defects are present, QA initiates a corrective action for the responsible party who develops and implements a response that eliminates the defect. If systematic defects are not present and the resolution is satisfactory, the QA Staff will close the complaint/inquiry with a no further action is necessary tag.

15.2 ***Documentation***. Client's complaints are documented by the individual receiving the complaint using the Data Query and Corrective Action Inquiry Process. This process generates an E-Mail message that contains detailed information essential to the complaint resolution. A record of the telephone conversation is maintained by client services. The message is distributed to the QA staff and the party bearing responsibility for resolution by E-Mail. The complaint resolution is documented on the message by the responsible party and returned to the originator. A copy is sent to QA for review and database archiving.

15.3 ***Corrective Action***. Responses to data queries are required from the responsible party. At a minimum, the response addresses the query and provides an explanation to the complaint. Formal corrective action may focus on the single issue expressed in the complaint. Corrective action may include reprocessing of data, editing of the initial report, and re-issue to the client. If the QA review indicates a systematic error, process modification is required. The defective process at the root of the complaint is changed. SOPs are either created or modified to reflect the change. The party responsible for the process implements process changes.

15.4 ***QA Monitoring***. Process changes, implemented to resolve systematic defects, are monitored for effectiveness by QA. If monitoring indicates that the process change has not resolved the defect, QA works with the department management to develop and implement an effective process. If monitoring indicates that the defect has been resolved, monitoring is slowly discontinued and the corrective action is closed. Continued monitoring is incorporated as an element of the annual system audit.

16.0 CONTROL OF NONCONFORMING PRODUCT

Requirement: Policies and procedures have been developed and implemented that describe the procedures employed by the laboratory when any aspect of sample analysis or data reporting do not conform to established procedures or client specifications. These procedures include steps to ensure that process defects are corrected and affected work is evaluated to assess its impact to the client.

Procedure. Nonconforming product is identified through routine internal review and audit practices or through client inquiry. The individuals who identify the nonconformance or receiving a nonconformance inquiry immediately inform the Laboratory Director and the Quality Assurance Director. The Laboratory Director initiates an evaluation of the nonconformance through the Quality Assurance Department and takes full responsibility for managing the process and identifying the course of action to take, initiating corrective action and mitigating the impact of the nonconformance to the client. Reference SOP EQA 065 Control of Non-Conforming Product and EQA 038 Complaints & Data Inquiry for specific procedures on handling non-conformances and Data Inquires.

16.1 ***Corrective Action.*** The outcome of the evaluation dictates the course of action. This includes client notification when the quality of data reported has been impacted and may also include corrective action if applicable. Immediate corrective action is performed using the procedures specified in SGS Accutest Inc. SOP EQA011. However, additional action may be required including cessation of analysis and withholding and or recalling data reports. If the evaluation indicates that nonconforming data may have been issued to clients, the client is immediately notified and data may be recalled following the procedures specified in SOP EQA011. If work has been stopped because of a nonconformance, the Laboratory Director is the only individual authorized to direct a resumption of analysis.

Non-conformances caused by systematic process defects require retraining of the personnel involved as an element of the corrective action solution.

17.0 CONFIDENTIALITY PROTECTION PROCEDURES

Requirements: Policies and procedures have been developed to protect client data from release to unauthorized parties or accidental release of database information through accidental electronic transmission or illegal intrusion. These policies have been communicated to clients and staff. Electronic systems are regularly evaluated for effectiveness.

17.1 ***Client Anonymity***. Information related to the Company's clients is granted to employees on a "need to know" basis. An individual's position within the organization defines his "need to know". Individuals with "need to know" status are given password access to systems that contain client identity information and access to documents and document storage areas containing client reports and information. Access to client information by individuals outside of the Company is limited to the client and individuals authorized by the client.

Individuals outside of the Company may obtain client information through subpoena issued by a court of valid jurisdiction. Clients are informed when subpoenas are received ordering the release of their information.

Client information may be released directly to regulatory agencies without receiving client authorization under specified circumstances. These circumstances require that the regulatory agency have statutory authority under the regulations for laboratory certification and that SGS Accutest Inc.'s operations fall under the purview of the regulation. In these situations, SGS Accutest Inc. will inform the client of the regulatory agencies request for information pertaining to his data and proceed with the delivery of the information to the regulatory agency.

17.2 ***Documents***. Access to client documents is restricted to employees in need to know positions. Copies of all client reports are stored in secure electronic archives with restricted access. Reports and report copies are distributed to individuals who have been authorized by the client to receive them. Data reports or data are not released to third parties without verbally expressed or written permission from the client.

17.3 ***Electronic Data***.

Database Intrusion. Direct database entry is authorized for employees of SGS Accutest Inc. only on a need to know basis. Entry to the database is restricted through a user specific multiple password entry system. Direct access to the database outside the facility is possible through secured channels set up by SGS Accutest Inc. A unique password is required for access to the local area network. A second unique password is required to gain access to the database. The staff receives read or write level authorization on a hierarchical privilege basis.

Internet Access. Access to client information is through an HTTP Web application only. It does not contain a mechanism that allows direct access to the database. Clients can gain access to their data only using a series of SGS Accutest Inc. assigned client and user specific passwords. The viewable data, which is encrypted during transmission, consists of an extraction of database information only.

Client Accessibility. Accessibility to client data delivered via electronic means follows strict protocols to insure confidentiality. Clients accessing electronic data are assigned a company account. The account profile, which is established by the MIS staff, grants explicit access to specific information pertaining to the client's project activity. Passwords are assigned on an individual basis within a client account. These accounts can be activated or deactivated by the MIS staff only.

17.4 ***Information Requests***. Client specific data or information is not released to third parties without verbally expressed or written permission from the client. Written permission is required from third parties, who contact the Company directly for the release of information. Verbal requests will be honored only if they are received directly from the client. These requests must be documented in a record of communication maintained by the authorized recipient.

17.5 ***Transfer of Records***. Archived data, which has previously been reported and transmitted to clients, is the exclusive property of SGS Accutest Inc. In the event of a cessation of business activities due to business failure or sale, The Company's legal staff will be directed to arrange for the final disposition of archived data.

The final disposition of archived data will be accomplished using the approach detailed in the following sequence:

1. All data will be transferred to the new owners for the duration of the required archive period as a condition of sale.

2. If the new owners will not accept the data or the business has failed, letters will be sent to clients listed on the most recent active account roster offering them the option to obtain specific reports (identified by SGS Accutest Inc. Job Number) at their own expense.

3. A letter will be sent to the TNI Standard accrediting authority with organizational jurisdiction over the company offering them the option to obtain all unclaimed reports at their own expense.

4. All remaining archived data will be recycled using the most expedient means possible.

18.0 QUALITY AUDITS AND SYSTEM REVIEWS

Requirement: The quality assurance group conducts regularly scheduled audits of the laboratory to assess compliance with quality system requirements, technical requirements of applied methodology, and adherence to documentation procedures. The information gathered during these audits is used to provide feedback to senior management and perform corrective action where needed for quality improvement purposes.

18.1 ***Quality System Reviews***. Quality system reviews are performed annually by the Quality Assurance Director for the Company President. In this review, the laboratory is evaluated for compliance with the laboratory Quality Systems Manual (QSM) and the quality system standards of the National Environmental Laboratory Accreditation Conference. Findings, which indicate non-compliance or deviation from the QSM, are flagged for corrective action. Corrective actions require either a return to compliance or a plan change to reflect an improved quality process. The Quality Assurance Director is responsible for making and documenting changes to the QSM. These changes are reviewed by the Company President and The Laboratory Director prior to the approval of the revised system.

18.2 ***Quality System Audits.*** Quality system audits are conducted to evaluate the effectiveness and laboratory compliance with individual quality system elements. These audits are conducted on an established schedule. Audit findings are documented and communicated to the management staff and entered into the corrective action system for resolution. If necessary, retraining is conducted to assure complete understanding of the system requirements.

18.3 ***Test Method Assessments.*** Test Method Assessments are performed throughout the year following an established schedule. Selected analytical procedures are evaluated for compliance with standard operating procedures (SOPs) and method requirements. If non-conformances exist, the published method serves as the standard for compliance. SOPs are edited for compliance if the document does not reflect method requirements. Analysts are trained to the new requirements and the process is monitored by quality assurance. Analysts are retrained in method procedures if an evaluation of bench practices indicates non-compliance with SOP requirements.

18.4 ***Documentation Audits***. Documentation audits are conducted during routine internal audits. The audit includes a check of measurement processes that require manual documentation. It also includes checks of data archiving systems and a search to find and remove any inactive versions of SOPs that may still be present in the laboratory and being accessed by the analysts. Non-conformances are corrected on the spot. Procedural modifications are implemented if the evaluation indicates a systematic defect.

18.5 ***Corrective Action Monitoring***. Defects or non-conformances that are identified during client or internal audits are documented in the corrective action systems and corrected through process modifications and/or retraining. Once a corrective action has been designed and implemented, it is monitored for compliance on a regular basis by the QA staff. Spot corrections are performed if the staff is not following the new procedure. Monitoring of the corrective action continues until satisfactory implementation has been verified.

18.6 ***Preventive Action.*** Laboratory systems or processes, which may be faulty and pose the potential for non-conformances, errors, confusing reports or difficulties establishing traceability may be identified during internal audits. These items are highlighted for systematic change using the corrective action system and managed to resolution using the procedures for corrective action identified in EQA041.

18.7 ***Client Notification.*** Defective processes, systematic errors, and quality defects, detected during routine audits may have negative impacts on data quality. In some cases, data that has been released to clients may be affected. If defective data has been released for use, SGS Accutest Inc. will immediately notify the affected clients of the defect and provide specific details regarding the magnitude of the impact to their data.

18.8 ***Management Reports.*** Formal reports of all audit and proficiency testing activity are prepared for the management staff and presented as they occur. Additional reports may be presented orally at regularly scheduled staff meetings

Management reports may also address the following topics:

- Status and results of internal and external audits,
- Status and results of internal and external proficiency testing,
- Identification of quality control problems in the laboratory,
- Discussion of corrective action program issues,
- Status of external certifications and approvals,
- Status of staff training and qualifications,
- Discussion of new quality system initiatives.
- Recommendations for further action on listed items are included in the report.

19.0 HEALTH AND SAFETY

Requirement. The company operates a formal health and safety program that complies with the requirements of the Occupational Health and Safety Administration. The program consists of key policies and practices that are essential to safe laboratory operation. All employees are required to receive training on the program elements. Job specific training is conducted to assure safe practices for specific tasks. All employees are required to participate in the program, receive initial and annual training, and comply with the program requirements. All plan and program requirements are detailed in the Health and Safety Program Manual.

19.1 **Policy.** SGS Accutest Inc. Laboratories will provide a safe and healthy working environment for its employees and clients while protecting the public and preserving the Company's assets and property. The company will comply with applicable government regulations pertaining to safety and health in the laboratory and the workplace.

The objective of the SGS Accutest Inc. Health and Safety Program is to promote safe work practices that minimize the occurrence of injuries and illness to the staff through proper health and safety training, correct laboratory technique application and the use of engineering controls.

19.2 **Responsibilities.** The Health and Safety Program assists managers, supervisors and non-supervisory employees in control of hazards and risks to minimize the potential for employee and client injuries, damage to client's property and damage or destruction to SGS Accutest Inc.'s facility.

The Director, Health and Safety (EHS Director) is responsible for implementing the Program's elements and updating its contents as necessary. He/she also conducts periodic audits to monitor compliance and assess the program's effectiveness. The EHS Director is also responsible for creating and administering safety training for all new and existing employees.

The employee is responsible for following all safety rules established for their protection, the protection of others and the proper use of protective devices provided by the Company. The employee is also expected to comply with the requirements of the program at all times. Department Managers and Supervisors are responsible for ensuring the requirements of the Safety Program are practiced daily. The Company President retains the ultimate responsibility for the program design and implementation.

19.3 **Program Elements.** The SGS Accutest Inc. Health and Safety Program consists of key program elements that complement the company's health and safety objective. These elements form the essence of the health and safety policy and assure that the objectives of the program are achieved.

***Safety Education and Training and Communication*.** Training is conducted to increase the staff's awareness of laboratory hazards and their knowledge of the safety practices and procedures required to protect them from those hazards. It is also used to communicate general safety procedures required for safe operation in a chemical laboratory.

Initial health and safety training for new employees is conducted during orientation. The training focuses on the SGS Accutest Inc. Safety and Health Program and includes specific training for the hazards that may be associated with the employees duties. Training is also conducted for all program elements focusing on general, acceptable, laboratory safety procedures. Targeted training is conducted to address hazards or safety procedures that are specific to individual employee's work assignments. All training activities are documented and archived in individual training folders. A health and safety training inventory is maintained in the training database.

Safety Committee. The safety committee provides the employee with an opportunity to express their views and concerns on safety issues in a forum where those concerns will be addressed. This committee meets monthly to assure that the interests of the company and the well being of the employee are protected. They also serve as a catalyst for elevating the level of safety awareness among their peers.

Hazard Identification and Communication. The hazard communication program enables employees to readily identify laboratory hazards and the procedures to protect themselves from those hazards. This program complies with OSHA's Hazard Communication Standard, Title 29 Code of Federal Regulations 1910.1200 that requires the company to adopt and adhere to the following key elements:

- Safety Data Sheets (SDS) must be available to any employee wishing to view them,
- The Company must maintain a Hazardous Chemicals Inventory (by location), which is updated on an annual basis,
- Containers are properly labeled,
- All employees must be provided with annual Hazard Communication and Right to Know training,

The hazard communication program also complies with the requirements of the New Jersey Worker and Community Right to Know Law, NJAC 8:95.

Identification of Workplace Hazards. The workplace hazard identification procedures have been designed to assure that hazards that have the potential to cause personnel injury or destruction of property are identified, managed and/or systematically eliminated from the operation. This system eliminates hazards, limits the potential for injury and increases the overall safety of the work environment.

Employee Exposure Assessment. Employee exposure assessment is performed to identify and evaluate potential exposure hazards associated with the employees work station. The exposure assessment data is used to determine if changes or modifications to the work station are needed to limit exposure to laboratory conditions that could negatively affect an employee's health or disclosed existing medical conditions.

Bloodborne Pathogens. SGS Accutest Inc. has implemented awareness training on the OSHA Bloodborne Pathogen Standard, 29CFR1910.1030 to reduce occupational exposure to Hepatitis B Virus (HBV), Human Immunodeficiency Virus (HIV) and other bloodborne pathogens that employees may encounter in their workplace.

Respiratory Protection Plan. The respiratory protection plan assures that SGS Accutest Inc. employees are protected from exposure to respiratory hazards. This program is used in situations where engineering controls and/or safe work practices do not completely control the identified hazards. In these situations, respirators and other protective equipment are used. Supplemental respiratory protection procedures are applied to specified maintenance personnel, employees who handle hazardous wastes in the hazardous waste storage area, and any employee that voluntarily elects to wear a respirator.

Chemical Hygiene Plan. The Chemical Hygiene Plan complies with the requirements of the Occupational Safety and Health Administration's Occupational Exposure to Hazardous Chemicals in the Laboratory Standard, 29 CFR 1910.1450. This plan establishes procedures, identifies safety equipment, personal protective equipment, and work practices that protect employees from the hazardous chemicals in the laboratory when properly used and applied.

Chemical Spill Response Plan. The chemical spill response plan has been designed to minimize the risks from a chemical spill or accidental chemical release in the laboratory. Risk minimization is accomplished through a planned response that follows a defined procedure. The designated staff have been trained to execute spill response procedures according to the specifications of the plan, which identifies the appropriate action to be taken based on the size of the spill.

Emergency Action & Evacuation Plan. The Emergency Action and Evacuation Plan details the procedures used to protect and safeguard SGS Accutest Inc.'s employees and property during emergencies. Emergencies are defined as fires or explosions, gas leaks, building collapse, hazardous material spills, emergencies that immediately threaten life and health, bomb threats and natural disasters such as floods, hurricanes or tornadoes, terrorism or terrorist actions. The plan identifies and assigns responsibility for executing specific roles in situations requiring emergency action. It also describes the building security actions coinciding with the "Alert Condition", designated by the Department of Homeland Security.

Lockout/Tagout Plan. Lockout/tagout procedures have been established to assure that laboratory employees and outside contractors take steps to render equipment inoperable and/or safe before conducting maintenance activities. The plan details the procedures for conducting maintenance on equipment that has the potential to unexpectedly energize, start up, or release energy or can be operated unexpectedly or accidentally resulting in serious injury to employees. The plan ensures that employees performing maintenance render the equipment safe through lock out or tag out procedures.

Personal Protection Policy. Policies have been implemented which detail the personal protection requirements for employees. The policy includes specifications regarding engineering controls, personal protective equipment (PPE), hazardous waste, chemical exposures, working with chemicals and safe work practices. Safety requirements specific to processes or equipment are reviewed with the department supervisor or the EHS Director before beginning operations.

Visitor and Contractor Safety Program. A safety brochure is given to all visitors and contractors who visit or conduct business at the facility. The brochure is designed to inform anyone who is not an employee of SGS Accutest Inc. of the laboratory safety procedures. The brochure directs them to follow all safety programs and plans while on SGS Accutest Inc. property. This program also outlines procedures for visitors and contractors in the event of an emergency. Visitors are required to acknowledge receipt and understanding of the SGS Accutest Inc. policy.

Appendix I

Glossary of Terms

GLOSSARY OF TERMS

Acceptance Criteria: specified limits placed on characteristics of an item, process, or service defined in requirement documents.

Accuracy: the degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.

Analyst: the designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

Audit: a systematic evaluation to determine the conformance to quantitative *and qualitative* specifications of some operational function or activity.

Batch: environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to 20 environmental samples of the same TNI Standard-defined matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group.

Blank: a sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results.

Blind Sample: a sub-sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process.

Calibration: to determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter, instrument, or other device. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements.

Calibration Curve: the graphical relationship between the known values, such as concentrations of a series of calibration standards and their instrument response.

Calibration Method: a defined technical procedure for performing a calibration.

Calibration Range: the range of concentrations between the lowest and highest calibration standards of a multi-level calibration curve. For metals analysis with a single-point calibration, the low-level calibration check standard and the high standard establish the linear calibration range, which lies within the linear dynamic range.

Calibration Standard: a substance or reference material used to calibrate an instrument.

Certified Reference Material (CRM): a reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation, which is issued by a certifying body.

Chain of Custody (COC): an unbroken trail of accountability that ensures the physical security of samples and includes the signatures of all who handle the samples.

Confirmation: verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to second column confirmation, alternate wavelength, derivatization, mass spectral, interpretation, alternative detectors or, additional cleanup procedures.

Continuing Calibration Verification (CCV): the verification of the initial calibration that is required during the course of analysis at periodic intervals. Continuing calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models.

Corrective Action (CA): the action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence.

Data Reduction: the process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form.

Demonstration of Capability (DOC): a procedure to establish the ability of the analyst to generate acceptable accuracy.

Documentation of Understanding (DOU): certifies that the analyst or technician has read and understood the procedures detailed in the Standard Operating Procedure (SOP) and will follow the SOP as written.

Document Control: the act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled to ensure use of the correct version at the location where the prescribed activity is performed.

Duplicate Analyses (DUP): the analyses or measurements of the variable of interest performed identically on two sub-samples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory.

Field of Testing: TNI Standard's approach to accrediting laboratories by program, method and analyte. Laboratories requesting accreditation for a program-method-analyte combination or for an up-dated/improved method are required submit to only that portion of the accreditation process not previously addressed (see TNI Standard, section 1.9ff).

Laboratory Control Sample-LCS (such as laboratory fortified blank, spiked blank, or QC check sample): a sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes from a source independent of the calibration standards or a material containing known and verified amounts of analytes. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

Limit of Detection (LOD): an estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte- and matrix-specific. DoD clarification is the smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate (Type II error) is 1%.

Limit of Quantitation (LOQ): the minimum levels, concentrations, or quantities of a target analyte that can be reported with a specified degree of confidence. DoD clarification is the lowest concentration that produces a quantitative result within specified limits of precision and bias. The LOQ shall be at or above the concentration of the lowest initial calibration standard.

Matrix: the component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

Aqueous: any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.

Drinking Water: any aqueous sample that has been designated a potable or potential potable water source. Saline/Estuarine: any aqueous sample from an ocean or estuary, or other salt-water source such as the Great Salt Lake. Non-aqueous Liquid: any organic liquid with <15% settleable solids.

Solids: includes soils, sediments, sludges and other matrices with >15% settleable solids.

Chemical Waste: a product or by-product of an industrial process that results in a matrix not previously defined.

Air: whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbent tube, impinger solution, filter, or other device.

Biota: animal or plant tissue, consisting of entire organisms, homogenates, and/or organ or structure specific subsamples.

Matrix Spike-MS (spiked sample or fortified sample): a sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix Spike Duplicate -MSD (spiked sample or fortified sample duplicate): a second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.

Method Blank (MB): a sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest, which is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.

Method Detection Limit (MDL): the minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

National Environmental Laboratory Accreditation Program (NELAP): the overall National Environmental Laboratory Accreditation Program.

NELAP Standards: the plan of procedures for consistently evaluating and documenting the ability of laboratories performing environmental measurements to meet nationally defined standards established by the National Environmental Laboratory Accreditation Conference.

Performance Audit: the routine comparison of independently obtained *qualitative and quantitative* measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory.

Precision: the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms.

Preservation: refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample.

Proficiency Testing: a means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source.

Proficiency Test Sample (PT): a sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria.

Quality Assurance: an integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.

Quality Control (QC): the overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users.

Quality Manual: a document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.

Quality System: a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC.

Reporting Limits (RL): the maximum or minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be quantified with the confidence level required by the data user.

Reagent Blank (method reagent blank or method blank): a sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps.

Reference Material: a material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.

Reference Method: a method of known and documented accuracy and precision issued by an organization recognized as competent to do so.

Reference Standard: a standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived.

Replicate Analyses: the measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval.

Sample Duplicate (SD): two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method including sampling and analysis.

Spike: a known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

Standard: the document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of TNI Standard and meets the approval requirements of TNI Standard procedures and policies.

Traceability: the property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons.

Validation: the process of substantiating specified performance criteria.

Work Cell: A defined group of analysts that together perform the method analysis. Members of the group and their specific functions within the work cell must be fully documented. A "work cell" is considered to be all those individuals who see a sample through the complete process of preparation, extraction, or analysis. The entire process is completed by a group of capable individuals; each member of the work cell demonstrates capability for each individual step in the method sequence.

Appendix II

Standard Operating Procedures Directory

SGS Accutest Inc. Laboratories
Standard Operating Procedures

Section	Standard Operating Procedure Title	Number
Air Toxics	Air Analysis by TO-15	EAT001
Air Toxics	Summa Canister Cleaning and Certification	EAT002
Air Toxics	Air Analysis of Tedlar Bag/Summa Canister by TO-3	EAT003
Air Toxics	Laboratory Analysis of Dissolved Gases in Aqueous Samples	EAT004
Air Toxics	Air Analysis by NJDEP – SRWM Low Level USEPA TO-15	EAT005
Air Toxics	Calibration of Flow Controllers	EAT006
Air Toxics	Air Analysis by TO-15 for Minnesota Department of Health	ETA007
General Chem	Percent Solids - SM2540 G-97, ASTM D4643-00	EGN007
General Chem	Anionic Surfactants As MBAS	EGN008
General Chem	Nonionic Surfactants as CTAS	EGN009
General Chem	Total Solids, 160.3, SM2540 B-97	EGN010
General Chem	Composite Sample	EGN015
General Chem	Total Dissolved Solids (Total Filterable Residue) SM2540 C-97	EGN020
General Chem	Settleable Solids, 160.5	EGN021
General Chem	Nitrate/Nitrite & Nitrate Only By Cad. Red. Analysis	EGN026
General Chem	Total Volatile Solids, 160.4	EGN030
General Chem	Chlorine, Total Residual And Free	EGN033
General Chem	Total Alkalinity, 310.1	EGN037
General Chem	Acidity (pH 8.2)	EGN044
General Chem	Bicarbonate, Carbonate, Free Carbon Dioxide	EGN045
General Chem	Viscosity	EGN067
General Chem	Total Suspended Solids (Non-Filterable Residue)	EGN087
General Chem	Chemical Oxygen Dem: Hach 8000, Aqueous Samples - Soil Modified	EGN099
General Chem	Hardness As Caco3 By Titration	EGN101
General Chem	Orthophosphate	EGN102
General Chem	Nitrogen, Nitrite -Total-Waters/Soluble-Soils	EGN103
General Chem	Turbidity, 180.1	EGN116
General Chem	Sulfide	EGN118
General Chem	Sulfite.	EGN119
General Chem	Apparent Color By Visual Comparison Method	EGN120
General Chem	Specific Conductance At 25.0 C	EGN124
General Chem	Chloride	EGN131
General Chem	Turbidity for Metals Drinking Waters	EGN132
General Chem	Odor & Odor at Elevated Temp.(Threshold Odor Test)	EGN133
General Chem	Biological Oxygen Demand (5 Day BOD)	EGN134
General Chem	Winkler Titration For DO Standardization	EGN135
General Chem	Dissolved Oxygen	EGN136
General Chem	Reactive Sulfide And Reactive Cyanide	EGN137
General Chem	Ignitability	EGN140
General Chem	TCLP - Semi-volatiles/Metals Extraction	EGN141
General Chem	TCLP- Volatiles Extraction	EGN142
General Chem	Paint Filter Test	EGN143
General Chem	Cyanides Amenable To Chlorination Preparation	EGN144
General Chem	Temperature	EGN146

SGS Accutest Inc. Laboratories
Standard Operating Procedures

Section	Standard Operating Procedure Title	Number
General Chem	Iodine, Colorimetric Analysis	EGN148
General Chem	pH by Electrode – Water	EGN151
General Chem	Salinity - SM182520B	EGN158
General Chem	pH & Corrosivity for Soils/ Solid Wastes SW486 9045	EGN200
General Chem	BTU (Gross Calorific Value)	EGN202
General Chem	Percent Sulfur	EGN203
General Chem	Bulk Density (Dry Basis)	EGN204
General Chem	Percent Ash (Dry Basis)	EGN205
General Chem	Total Organic Content	EGN206
General Chem	Cyanide (Lachat Autoanalyzer)	EGN207
General Chem	Total Chlorine ASTM D808-91	EGN208
General Chem	Total Organic Chlorine ASTM D808-91	EGN209
General Chem	Total Kjeldahl Nitrogen (Lachat Autoanalyzer)	EGN210
General Chem	Specific Gravity	EGN211
General Chem	Hexavalent Chromium (Soils)	EGN214
General Chem	Ammonia (Lachat Autoanalyzer)	EGN216
General Chem	Phenols (Lachat Autoanalyzer)	EGN217
General Chem	Total Organic Halides	EGN218
General Chem	Total Organic Halides, Solid And Oil Matrices	EGN219
General Chem	Pour Point	EGN221
General Chem	Base Sediment In Petroleum Samples	EGN222
General Chem	Water Content In Petroleum Samples	EGN223
General Chem	Ignitability, Bunsen Burner Method	EGN226
General Chem	Organic Matter (Loss on Ignition)	EGN227
General Chem	Sulfide Analysis For Reactive Sulfides	EGN228
General Chem	Hexavalent Chromium In Waters by EPA 7196a Mod.	EGN230
General Chem	Hexavalent Chromium In Waters by SM18 4500 CR D	EGN231
General Chem	Total Organic Carbon In Soil Samples	EGN233
General Chem	Total Organic Carbon In Aqueous Samples	EGN234
General Chem	pH and Corrosivity for Aqueous and Multiphasic Wastes	EGN238
General Chem	Synthetic Precipitation Leaching Procedure for Non-Volatile Anal.	EGN239
General Chem	Synthetic Precipitation Leaching Procedure for Volatile Analytes	EGN240
General Chem	Cation Exchange Capacity Of Soils (Sodium Acetate)	EGN242
General Chem	Ferrous Iron	EGN243
General Chem	Specific Gravity (For Sludges And Solids)	EGN247
General Chem	N-Hexane Extract. Mat. & Silica Gel Treatment by Gravimetric Anal.	EGN249
General Chem	Oil & Grease – Gravimetric Anal. (So & Sl) – Hexane Extraction	EGN250
General Chem	Neutral Leaching of Solid Waste Sam. Using Shake Extraction	EGN252
General Chem	Oxidation-Reduction Potential	EGN253
General Chem	Titrimetric Method For Free Carbon Dioxide	EGN255
General Chem	Total Phosphorous EPA 365.3	EGN256
General Chem	Dissolved Silica	EGN257
General Chem	Grain Size and Sieve Testing	EGN258
General Chem	Hardness By Calculation	EGN259

SGS Accutest Inc. Laboratories
Standard Operating Procedures

Section	Standard Operating Procedure Title	Number
General Chem	Spectrophotometer Calibration Check	EGN260
General Chem	Massachusetts Sieve Test	EGN262
General Chem	Volatile Suspended Solids	EGN264
General Chem	Unburned Combustibles (Volatile Solids)	EGN266
General Chem	Particulate Matter	EGN267
General Chem	Elutriate Preparation	EGN268
General Chem	Phosphorus, Hydrolyzable	EGN271
General Chem	Perchlorate by Ion Chromatography in Groundwater and Soil	EGN272
General Chem	Percent Lipids by Gravimetric Analysis	EGN273
General Chem	Cyanide Distillation/Aqueous Samples/Micro Method	EGN275
General Chem	Cyanide Distillation/Soil Samples/Micro Method	EGN276
General Chem	Calibration of General Chemistry Distillation Tubes	EGN277
General Chem	Phenols Distillation, Water Samples	EGN279
General Chem	Phenols Micro Distillation, Soil Samples	EGN280
General Chem	Inorganic Anions Determination by ion chromatography using IC 2000	EGN281
General Chem	Leaching of Solid Waste Samples using China Leaching Procedure	EGN283
General Chem	Ammonia Distillation, Water & Solid samples	EGN284
General Chem	Weak Acid Dissociable Cyanide / Micro-Distillation Method	EGN286
General Chem	Ferrous Iron for Hexavalent Chromium Sample Characterization	EGN288
General Chem	Calibration of Coliform Collection Bottles	EGN287
General Chem	Inorganic Carbon by Calculation	EGN289
General Chem	Procedure for Homogenization of Biota Samples	EGN290
General Chem	Hexavalent Chromium in Water by Ion Chromatography	EGN291
General Chem	Hexavalent Chromium in Soils by Ion Chromatography	EGN292
General Chem	Procedure for Wand Mixer Homogenization of Soil Samples	EGN293
General Chem	Hydrogen Sulfide	EGN294
General Chem	TCLPME-Multiple Extractions Procedure	EGN295
General Chem	Modified Elutriate Preparation	EGN296
General Chem	Procedure for Particle Size Reduction (Crushing) of Solid Matrices	EGN297
General Chem	Acid Volatile Sulfides	EGN298
General Chem	Pore Water Extraction from Soils for NVOC and Metals Analysis	EGN299
General Chem	Iodide, Colorimetric Analysis	EGN300
General Chem	Percent Solids and Moisture in Soil/Solid Matrices	EGN301
General Chem	Un-Ionized Ammonia	ENG302
General Chem	Density, ASTM Definition	EGN303
General Chem	HEM by Gravimetric Analysis Using Solid Phase Extraction	EGN304
General Chem	Hexavalent Chromium on Wipe Samples	EGN305
General Chem	Modified Mehlich Buffer pH	EGN306
General Chem	Screening Procedure to test for presence of sulfide	EGN307
General Chem	Black Carbon in Soil Samples	EGN308
General Chem	Physical Appearance (Sample Description)	EGN309
General Chem	Orthophosphate	EGN310
General Chem	Oxidizer Screen	EGN311
General Chem	Hexavalent Chromium by 218.7	EGN312
Facilities Maint.	Facilities Maintenance	EFM001

SGS Accutest Inc. Laboratories
Standard Operating Procedures

Section	Standard Operating Procedure Title	Number
Field Operations	Aqueous Grab Sampling Procedures	EFP001
Field Operations	Use of Automatic Wastewater Sampler	EFP002
Field Operations	Free and Total residual Chlorine	EFP003
Field Operations	Decontamination of Sampling Equipment	EFP004
Field Operations	Dissolved Oxygen	EFP005
Field Operations	Dissolved Oxygen by Winkler Titration	EFP006
Field Operations	Metal Sample Field Filtering Procedure	EFP008
Field Operations	Sampling Procedure for Monitoring Wells	EFP013
Field Operations	Subsurface Soil Sampling Procedure	EFP016
Field Operations	Surface Soil Sampling Procedure	EFP017
Field Operations	Residential Potable Well Sampling Procedure	EFP018
Field Operations	Potable Water Line Sampling Procedure	EFP019
Field Operations	Sampling for NJ Private Well Testing Act	EFP020
Field Operations	Field Sampling Coordinates by GPS	EFP021
Field Operations	Sampling Drinking Water Wells for Volatile Organics	EFP022
Field Operations	Sampling Drinking Water Wells for Metals	EFP023
Field Operations	Sampling Drinking Water Wells for Nitrates & Nitrites	EFP024
Field Operations	Sampling Drinking Water Wells for Gross Alpha	EFP025
Field Operations	Sampling Drinking Water Wells for Coliform Bacteria	EFP026
Field Operations	Sampling Drinking Water Wells for pH	EFP027
Field Operations	Documentation Requirements for Field Services	EFP028
Field Operations	Field Oxidation-Reduction Potential	EFP029
Field Operations	Turbidity, Field Test	EFP030
Field Operations	Analysis for Dissolved Oxygen by DO Probe	EFP031
Field Operations	Field pH in Water by Electrode	EFP032
Field Operations	Field Measurement of Specific Conductance and Resistivity	EFP033
Health & Safety	Contamination Avoidance Procedure	EHS001
Health & Safety	Measuring Face Velocities in Laboratory Fume Hoods	EHS002
Health & Safety	Proper Handling of Compressed Gas Cylinders	EHS003
Health & Safety	Sample and Waste Disposal (Formerly ESM003)	EHS004
Health & Safety	Handling and Management of Inorganic Wastes (Formerly EGN265)	EHS005
Health & Safety	Handling, Treatment, and Disposal of Foreign Soils	EHS006
Health & Safety	Management of Industrial Product Samples	EHS007
Health & Safety	Organic Prep Air Monitoring	EHS008
Health & Safety	Laboratory Visitor Safety Procedure	EHS009
Information Tech	Information Security & Integrity Procedure	EMI001
Information Tech	Procedures for Requesting Software or Software Revisions	EMI002
Information Tech	Development, Implementation, Delivery, & Revision of EDDs	EMI003
Information Tech	Data Systems Maintenance and Information Handling	EMI006
Metals Analysis	Mercury Analysis of Non-Potable and Potable Water Samples	EMA215
Metals Analysis	Metals by ICP-MS: EPA 200.8	EMA216

SGS Accutest Inc. Laboratories
Standard Operating Procedures

Section	Standard Operating Procedure Title	Number
Metals Analysis	Metals by ICP-MS: SW846 6020	EMA217
Metals Analysis	Metals by ICP Atomic Emission Spectrometry using Solid State ICP	EMA222
Metals Analysis	Metals by ICP Atomic Emission Spectrometry – EPA 200.7	EMA223
Metals Analysis	Low Level Mercury by EPA 1631	EMA224
Metals Analysis	Low Level Mercury by EPA 245.7	EMA225
Metals Analysis	Metals by inductively coupled plasma-Mass Spectrometry (ICP-MS)	EMA226
Metals Analysis	Metals by Inductively coupled plasma atomic emission spectrometry (ICP) using Using Solid State ICP	EMA227
Metals Analysis	Cold Vapor Analysis of Mercury For Soil Samples	EMA228
Metals Prep	Digestion of DW for ICP Analysis	EMP048
Metals Prep	Non-Potable Waters Digestion For ICP/Flame Analysis	EMP070
Metals Prep	Soil Digestion For ICP Analysis	EMP073
Metals Prep	Non-Potable Water Digestion for Flame/ICP (Total & Dissolved)	EMP081
Metals Prep	Digestion Of Non-Potable Waters For Total Recoverable Metals	EMP200
Metals Prep	Metals Spiking Solution and Standards Preparation and Use	EMP202
Metals Prep	Calibration of Metals Digestion Tubes	EMP203
Metals Prep	ICP and ICP/MS Analysis of TPPM-10 Filters	EMP207
Metals Prep	Digestion of Waters for Acid Extractable Metals	EMP208
Metals Prep	Lab Preservation Filtration of Metals Samples	EMP209
Microbiology	Microbiological Quality Control	EMB001
Microbiology	Coliform, Total By Colilert, SM18 9223 B	EMB002
Microbiology	Total Coliform: Membrane Filtration/Fecal Coliform Confirmation	EMB003
Microbiology	Total Plate Count SM18 9215B	EMB008
Microbiology	General Petroleum Degraders	EMB009
Microbiology	Calibration of Microbiology Coliform Collection Bottles	EMB010
Microbiology	Coliform, Fecal	EMB127
Organics-GC	Dibromo-3-chloropropane & 1,2,3-Trichloropropane	EGC504
Organics-GC	Acrolein and Acrylonitrile by EPA 603	EGC603
Organics-GC	Pesticides & PCBs in Wastewater by EPA 608	EGC608
Organics-GC	1,2-DBE, 1,2-DB-3-CP & 1,2,3-TCP by Micro-extraction and GC	EGC8011
Organics-GC	Pesticides Analysis by SW8081	EGC8081
Organics-GC	PCB Analysis SW8082	EGC8082
Organics-GC	Herbicides by SW846 – 8151	EGC8151
Organics-GC	Conn. Total Semi-volatile Petroleum Hydrocarbons	EGCCTGRO
Organics-GC	Alcohols by Direct Aqueous Injection GC/FID SW 8015	EGCALDAI
Organics-GC	Analysis of Explosives by GC/ECD	EGCBUSACH-PPM
Organics-GC	Connecticut Extractable Petroleum Hydrocarbon Analysis	EGCCTETPH
Organics-GC	Petroleum Range Organics Analysis By GC/FID (Florida)	EGCFLPRO
Organics-GC	Massachusetts Extractable Petroleum Hydrocarbons	EGCMAEPH
Organics-GC	Massachusetts Volatile Petroleum Hydrocarbons	EGCMAVPH
Organics-GC	New Jersey Extractable Petroleum Hydrocarbons	EGCNJEPH

SGS Accutest Inc. Laboratories
Standard Operating Procedures

Section	Standard Operating Procedure Title	Number
Organics-GC	Oil Identification by Gas Chromatography Fingerprint	EGCOILID
Organics-GC	Texas Total Petroleum Hydrocarbons	EGCTX1005
Organics-GC	Wisconsin Diesel Range Organics	EGCWIDRO
Organics-GC/MS	Volatile Organics in Drinking Water by EPA 524	EMS524
Organics-GC/MS	Volatile Organics in Wastewater by EPA 624	EMS624
Organics-GC/MS	Semi-Volatile Organics by EPA 625	EMS625
Organics-GC/MS	Volatile Organics by SW8260B	EMS8260B
Organics-GC/MS	Ethylene/Propylene Glycol Analysis DAI-GC/MS(SIM)	EMS8260DAI
Organics-GC/MS	Semi-Volatile Organics by SW8270	EMS8270
Organics-GC/MS	NDMA By chemical Ionization Gas Chromatography/mass spectrometry (GC/MS) With large volume injection	EMSNDMA
Organics Prep	Prep of Base Neutral/Acid Extractables: Water Matrices	EOP001
Organics Prep	Extraction of Semivolatile Organics from Solids By Sonication	EOP003
Organics Prep	Alumina Cleanup of Organic Extracts: SW3610	EOP005
Organics Prep	Continuous Liquid/Liquid Extraction Water: SW3520C	EOP007
Organics Prep	Sulfur Cleanup of Organic Extracts: SW846 3660B	EOP011
Organics Prep	Testing & Approval Of Organics Solvents	EOP013
Organics Prep	Preparation & Use of MDL Check Solution	EOP014
Organics Prep	Preparation of Petroleum Oils & Organic Wastes for PCBs by SW 8082	EOP017
Organics Prep	Removal of Sulfur from Extracts with Tetrabutylammonium Sulfite	EOP018
Organics Prep	Soxhlet Extraction of Solids For Semi-Volatile Organics	EOP020
Organics Prep	Preparation of Petroleum Products for EPA 8081	EOP021
Organics Prep	Preparation of Petroleum Products for BNA by EPA 8270C	EOP022
Organics Prep	Preparation for Aqueous DRO for Wisconsin	EOP023
Organics Prep	Solvent Extraction for Soil/Sediment DRO for Wisconsin	EOP024
Organics Prep	Pressurized Fluid Extraction (ASE)	EOP040A
Organics Prep	Microwave Extraction of Pesticides &/or PCBs from solid samples	EOP3546
Organics Prep	Calibration of Extract Vials	EOP026
Organics Prep	Alumina Column Cleanup SW3611	EOP3611
Organics Prep	Florisil Column Cleanup SW3620	EOP3620
Organics Prep	Silica Gel Cleanup SW3630	EOP3630
Organics Prep	Acid Base Partitioning SW3650	EOP3650
Organics Prep	Sulfuric Acid/Permanganate Cleanup SW3665	EOP3665
Organics Prep	Purge-And-Trap Extraction Of Aqueous Samples	EOP5030
Organics Prep	Collection/Preservation of Solids for VO Analysis: 5035	EOP5035
Organics Prep	Cleanup of Organic Extracts by Gel Permeation Chromatography	EOPGPC
Project Mgmt	Procedure For The Management Of Client Projects	EPM001
Project Mgmt	Client Specific Method Modifications	EPM002
Project Mgmt	Procedure For The Notification Of DW Exceedences	EPM003
Project Mgmt	Data Entry for Sample Log-In	EPM004
Project Mgmt	Subcontracting high volume	EPM005-01

SGS Accutest Inc. Laboratories
Standard Operating Procedures

Section	Standard Operating Procedure Title	Number
Quality Assurance	Preparation, Approval, Distribution & Archiving of SOPs	EQA001
Quality Assurance	Calibration of Analytical Balances	EQA002
Quality Assurance	Calibration of Thermometers	EQA003
Quality Assurance	Calibration and Use of Auto-Pipettes	EQA004
Quality Assurance	Temperature Monitoring-	EQA005
Quality Assurance	Sample Container Cleaning & Quality Control	EQA006
Quality Assurance	Calibration of Kuderna-Danish Collection Tubes	EQA007
Quality Assurance	Preparation and Analysis of Sample Preservatives	EQA008
Quality Assurance	Personnel Training and Analyst Proficiency	EQA009
Quality Assurance	Sample Batching Procedure	EQA010
Quality Assurance	Corrective Action Procedure	EQA011
Quality Assurance	Glassware Preparation For Inorganic Lab Use	EQA012
Quality Assurance	Preparation Of Glassware For Organics Extraction	EQA013
Quality Assurance	Standards Traceability Documentation Procedure	EQA014
Quality Assurance	Template for Standard Operating Procedures	EQA016
Quality Assurance	Management/Reporting Of Proficiency Test (PT) Samples	EQA017
Quality Assurance	Creating/Distributing/Tracking Internal Chains Of Custody	EQA018
Quality Assurance	Creating New Accounts	EQA019
Quality Assurance	Creating New Projects	EQA020
Quality Assurance	Creating Product Codes	EQA021
Quality Assurance	Procedures For The Purchase Of Laboratory Supplies	EQA023
Quality Assurance	Control & Archiving Of Laboratory Documents	EQA025
Quality Assurance	Confidentiality Protection Procedures	EQA027
Quality Assurance	Quality System Review	EQA028
Quality Assurance	Contract Review	EQA029
Quality Assurance	Procedure for the Development and Application of MDLs and RLs	EQA030
Quality Assurance	Subcontracting Procedures	EQA031
Quality Assurance	Signature Authority	EQA032
Quality Assurance	Review of Inorganic Data	EQA034
Quality Assurance	Review of Organic Data	EQA035
Quality Assurance	Documentation of Equipment Maintenance	EQA036
Quality Assurance	Procedures for Accepting Departures from Laboratory Specifications	EQA037
Quality Assurance	Client Complaints Resolution Procedure	EQA038
Quality Assurance	Employee Technical Ethics Responsibilities	EQA039
Quality Assurance	Internal Audit Procedure	EQA041
Quality Assurance	Procedure for Obtaining Representative Sample Aliquots	EQA042
Quality Assurance	Procedure for Development &use of In-House Q C Criteria	EQA043
Quality Assurance	Manual Integration of Chromatographic Peaks	EQA044
Quality Assurance	Deionized Water Quality Control	EQA046
Quality Assurance	Management and Control of Change	EQA047
Quality Assurance	Laboratory Equipment Purchase and Removal From Service	EQA048
Quality Assurance	Calibration of Microliter Syringes	EQA049
Quality Assurance	Autosampler Vial Labeling Procedure (formally EOP041-01)	EQA050
Quality Assurance	pH for Volatile Samples	EQA051
Quality Assurance	Quality Control Review of Data Packages	EQA054
Quality Assurance	Procedures for Determining Method Comparability	EQA055
Quality Assurance	Refrigerator Storage Holding Blank Procedure	EQA056

SGS Accutest Inc. Laboratories
Standard Operating Procedures

Section	Standard Operating Procedure Title	Number
Quality Assurance	Data Integrity Training Procedure	EQA057
Quality Assurance	Data Integrity Monitoring Procedure	EQA058
Quality Assurance	Procedure for Conducting Data Integrity Investigations	EQA059
Quality Assurance	Quality Control Requirements for Organics by GC/GCMS using EPA 500 & 600 Series, SW846 8000 Series and CLP Methodologies	EQA060
Quality Assurance	Procedure for the Confidential Reporting of Data Integrity Issues	EQA061
Quality Assurance	Calibration of Volumetric Dispensers for Volume Critical Processes	EQA062
Quality Assurance	Calibration of Volumetric Dispensers / Non-Critical Volumes Processes	EQA063
Quality Assurance	Glassware Preparation for use in VOA analysis	EQA064
Quality Assurance	Control of Non-Conforming Product	EQA065
Quality Assurance	Client Notification of Key Personnel Changes	EQA066
Quality Assurance	Review of Inorganic Notebooks	EQA067
Quality Assurance	Disposal of Spent Semi-Volatile Organic Extracts	EQA068
Quality Assurance	Compressed Gas Management	EQA069
Quality Assurance	Procedure for Tracking Quality Control Non-Conformances	EQA070
Quality Assurance	Procedure for the Development and Application of Experimental Method Detection Limits, limits of detection, and limits of quantitation for inorganic applications	EQA071
Quality Assurance	Procedure for Particle Size Reduction (Crushing)/Homogenization of solid matrices	EQA072
Quality Assurance	Compositing Samples	EQA073
Report Generation	Report Generation–Data Package	ERG002
Sample Mgmt.	Sample Storage	ESM001
Sample Mgmt.	Chain Of Custody And Log In Procedure	ESM002
Sample Mgmt.	Temperature Maintenance Of Shipping Coolers	ESM004
Sample Mgmt.	Cooler Packaging And Shipping Procedure	ESM008
Sample Mgmt.	Procedures for Sample Couriers	ESM011
Sample Mgmt.	Summa Canister Shipment & Retrieval: NJDEP 03-X-35135	ESM012

Appendix III

Analytical Capabilities

Method Capabilities by NELAP Accredited Fields of Testing

Analytes	Method Number	Program	Chemistry Field
Alkalinity	SM 2320 B-11	Drinking Water	Inorganic Analysis
Ammonia	SM 4500-NH_3 H-11	Drinking Water	Inorganic Analysis
Chloride, Fluoride, Sulfate	EPA 300.0	Drinking Water	Inorganic Analysis
Chlorine, Total Residual	SM 4500-CL F-11	Drinking Water	Inorganic Analysis
Color, Apparent	SM 2120 B-11	Drinking Water	Inorganic Analysis
Conductivity	SM 2510 B-11	Drinking Water	Inorganic Analysis
Cyanide	EPA 335.4	Drinking Water	Inorganic Analysis
Foaming Agents (MBAS)	SM 5540 C-11	Drinking Water	Inorganic Analysis
Nitrate	EPA 353.2	Drinking Water	Inorganic Analysis
Nitrite	SM 4500-NO_2 B	Drinking Water	Inorganic Analysis
Odor	SM 2150 B-11	Drinking Water	Inorganic Analysis
Organic Carbon, Total (TOC)	SM 5310 B-11	Drinking Water	Inorganic Analysis
Dissolved Organic Carbon (DOC)	5310 B, C, D	Drinking Water	Inorganic Analysis
Orthophosphate	SM 4500-P E-11	Drinking Water	Inorganic Analysis
Perchlorate	EPA 314.0	Drinking Water	Inorganic Analysis
pH, Hydrogen Ion	SM 4500-H^+ B-11	Drinking Water	Inorganic Analysis
Silica, Dissolved	SM 4500-Si D(18th/19th ed)	Drinking Water	Inorganic Analysis
Temperature	SM 2550 B	Drinking Water	Inorganic Analysis
Total Dissolved Solids	SM 2540 C-11	Drinking Water	Inorganic Analysis
Total Organic Halides (TOX)	SM 5320 B	Drinking Water	Inorganic Analysis
Turbidity	EPA 180.1	Drinking Water	Inorganic Analysis
Hardness, Calcium	EPA 200.7	Drinking Water	Metals Analysis
Hardness, Total	EPA 200.7	Drinking Water	Metals Analysis
Hardness, Total	SM 2340 C-11	Drinking Water	Metals Analysis
Mercury	EPA 245.1	Drinking Water	Metals Analysis
Metals	EPA 200.7	Drinking Water	Metals Analysis
Metals	EPA 200.8	Drinking Water	Metals Analysis
DBCP, EDB & TCP	EPA 504.1	Drinking Water	Organics Analysis
Volatile Organics	EPA 524.2	Drinking Water	Organics Analysis
Total Coliform/E. Coli	SM 9223 B	Drinking Water	Microbiology
Heterotrophic Bacteria	SM 9215 B	Drinking Water	Microbiology

Method Capabilities by NELAP Accredited Fields of Testing

Analytes	Method Number	Program	Chemistry Field
Acidity as $CaCO_3$	SM 2310 B-11	Wastewater	Inorganic Analysis
Alkalinity as $CaCO_3$	SM 2320 B-11	Wastewater	Inorganic Analysis
Ammonia	SM20 4500-NH_3-B+H-11	Wastewater	Inorganic Analysis
Biochemical Oxygen Demand	SM 5210 B-11	Wastewater	Inorganic Analysis
Bromide, Chloride, Fluoride, Sulfate	EPA 300.0	Wastewater	Inorganic Analysis
Carbonaceous BOD (CBOD)	SM 5210 B-11	Wastewater	Inorganic Analysis
Chemical Oxygen Demand (COD)	SM 5220 B or C-11	Wastewater	Inorganic Analysis
Chloride	SM 4500-Cl C-11	Wastewater	Inorganic Analysis
Chlorine, Total Residual	SM 4500-Cl F-11	Wastewater	Inorganic Analysis
Chromium (VI)	SM 3500-Cr B-11	Wastewater	Inorganic Analysis
Chromium (VI)	EPA 218.7	Wastewater	Inorganic Analysis
Color, Apparent	SM 2120 B-11	Wastewater	Inorganic Analysis
Cyanide (Sample Preparation)	SM 4500-CN C+E-11	Wastewater	Inorganic Analysis
Cyanide (Analytical Finish)	EPA 335.4	Wastewater	Inorganic Analysis
Cyanide Amenable to Chlorine	SM 4500-CN-B or C-11+G-11	Wastewater	Inorganic Analysis
Hardness, Total as $CaCO_3$	SM 2340C-11	Wastewater	Inorganic Analysis
Iron, Ferrous	SM 3500-Fe B-11	Wastewater	Inorganic Analysis
Kjeldahl Nitrogen, Total	EPA 351.2	Wastewater	Inorganic Analysis
Nitrate/Nitrite	EPA 353.2	Wastewater	Inorganic Analysis
Nitrite	SM 4500-NO_2 B-11	Wastewater	Inorganic Analysis
Oil & Grease, HEM-LL	EPA 1664A	Wastewater	Inorganic Analysis
Oil & Grease, SGT-HEM, Non-Polar	EPA 1664A	Wastewater	Inorganic Analysis
Organic Nitrogen	SM 4500-N B+G EPA 351.2	Wastewater	Inorganic Analysis
Orthophosphate	EPA 365.3	Wastewater	Inorganic Analysis
Oxygen, Dissolved, Winkler	SM 4500-O C-11	Wastewater	Inorganic Analysis
Oxygen, Dissolved	SM 4500-O G-11	Wastewater	Inorganic Analysis
pH Hydrogen Ion	SM 4500-H B-11	Wastewater	Inorganic Analysis
pH Aqueous Electrometric	SW-846 9040C	Wastewater	Inorganic Analysis
Temperature Thermometric	SM 2550 B-00	Wastewater	Inorganic Analysis
Phenols	EPA 420.4	Wastewater	Inorganic Analysis
Phenols (Analytical Finish)	SW846 9066	Wastewater	Inorganic Analysis
Phosphorus (Total)	EPA 365.3	Wastewater	Inorganic Analysis
Residue, Filterable (TDS)	SM 2540 C-11	Wastewater	Inorganic Analysis
Residue, Nonfilterable (TSS)	SM 2540 D-11	Wastewater	Inorganic Analysis

Method Capabilities by NELAP Accredited Fields of Testing

Analytes	Method Number	Program	Chemistry Field
Residue, Settleable	SM 2540 F-11	Wastewater	Inorganic Analysis
Residue, Total	SM 2540 B-11	Wastewater	Inorganic Analysis
Residue, Volatile	EPA 160.4	Wastewater	Inorganic Analysis
Total, fixed, and volatile solids (SQAR)	SM 2540 G, 18th Ed.	Wastewater	Inorganic Analysis
Salinity	SM 2520 B-11	Wastewater	Inorganic Analysis
Silica, Dissolved	SM 4500-SiO_2 C-11	Wastewater	Inorganic Analysis
Specific Conductance	SM 2510 B-11	Wastewater	Inorganic Analysis
Specific Conductance	SW846 9050A	Wastewater	Inorganic Analysis
Sulfide (S)	SM 4500-S B,C + F-11	Wastewater	Inorganic Analysis
Sulfite (SO_3)	SM 4500-SO_3 B-11	Wastewater	Inorganic Analysis
Surfactants (Methylene Blue)	SM 5540 C-11	Wastewater	Inorganic Analysis
Temperature	SM 2550 B-00	Wastewater	Inorganic Analysis
Total Organic Carbon (TOC)	SM 5310 B-11	Wastewater	Inorganic Analysis
Total Organic Halides (TOX)	SW846 9020B	Wastewater	Inorganic Analysis
Turbidity	EPA 180.1	Wastewater	Inorganic Analysis
Metals, Total – Water	SW846 3010A	Wastewater	Metals Prep
Metals, Total – Water, Rec. + Dissolved	SW846 3005A	Wastewater	Metals Prep
Hardness, Total as $CaCO_3$	EPA 200.7	Wastewater	Metals Analysis
Hardness, Total as $CaCO_3$	SM 2340 C-11	Wastewater	Metals Analysis
Mercury	EPA 245.1	Wastewater	Metals Analysis
Metals, ICP	EPA 200.7	Wastewater	Metals Analysis
Metals, ICP/MS	EPA 200.8	Wastewater	Metals Analysis
Mercury, Low-Level	EPA 245.7	Wastewater	Metals Analysis
Mercury, Low-Level	EPA 1631E	Wastewater	Metals Analysis
Mercury, Liquid Waste	SW846 7470A	Wastewater	Metals Analysis
Separatory Funnel Extraction	SW-846 3510C	Wastewater	Semivolatile Organics
Continuous Liquid-Liquid Extraction	SW-846-3520C	Wastewater	Semivolatile Organics
Purge & Trap Aqueous	SW-846 5030B	Wastewater	Volatile Organics
Acrolein & Acrylonitrile	EPA 603	Wastewater	Organics Analysis
Base/Neutrals and Acids	EPA 625	Wastewater	Organics Analysis
Extractable Petroleum Hydrocarbons	NJDEP EPH	Wastewater	Organics Analysis
Organochlorine Pests & PCBs	EPA 608	Wastewater	Organics Analysis

Method Capabilities by NELAP Accredited Fields of Testing

Analytes	Method Number	Program	Chemistry Field
Petroleum Hydrocarbons	NJ-OQA-QAM-25	Wastewater	Organics Analysis
Volatile Organics	EPA 624	Wastewater	Organics Analysis
Semi-Volatile Organics GC/MS, Extract or Dir Inj, Capillary	SW-846 8270C SW-846 8270D	Wastewater	Semivolatile Organic Analysis
Coliform, Fecal (Count per 100 mL)	SM 9222 D-97	Wastewater	Microbiology
Coliform, Total (Count per 100 mL)	SM 9222 B-97	Wastewater	Microbiology
Heterotrophic Plate Count	SM 9215 B-00	Wastewater	Microbiology
Soluble Sulfides	SW846 9034	Solid/Haz. Waste	Inorganic Analysis
Bomb Calorimetry	ASTM D-240	Solid/Haz. Waste	Inorganic Analysis
Bromide, Chloride, Fluoride, Sulfate	SW846 9056/A	Solid/Haz. Waste	Inorganic Analysis
Cation, Exchange Capacity	SW846 9081	Solid/Haz. Waste	Inorganic Analysis
Chromium (VI) Digestion	SW846 3060A	Solid/Haz. Waste	Inorganic Analysis
Chromium (VI)	SW846 7196A	Solid/Haz. Waste	Inorganic Analysis
Chromium (VI)	SW846 7199	Solid/Haz. Waste	Inorganic Analysis
Corrosivity/pH, >20% H2O	SW846 9040C	Solid/Haz. Waste	Inorganic Analysis
Cyanide	SW846 9010C	Solid/Haz. Waste	Inorganic Analysis
Cyanide, Amenable to Chlorine	SW846 9010C	Solid/Haz. Waste	Inorganic Analysis
Cyanide	SW846 9012B	Solid/Haz. Waste	Inorganic Analysis
Extractable Organic Halides	SW846 9023	Solid/Haz. Waste	Inorganic Analysis
Free Liquid	SW846 9095	Solid/Haz. Waste	Inorganic Analysis
Ignitability	SW846 1010A	Solid/Haz. Waste	Inorganic Analysis
Oil & Grease, HEM	EPA 1664A	Solid/Haz. Waste	Inorganic Analysis
Oil & Grease and Sludge, HEM	SW846 9071B	Solid/Haz. Waste	Inorganic Analysis
pH, Hydrogen Ion	SW846 9040C	Solid/Haz. Waste	Inorganic Analysis
pH, Soil and Waste	SW846 9045D	Solid/Haz. Waste	Inorganic Analysis
Phenols (Sample Preparation)	SW846 9065	Solid/Haz. Waste	Inorganic Analysis
SPLP Metals/Organics	SW846 1312	Solid/Haz. Waste	Inorganic Analysis
TCLP Metals/Semi Volatile Organics	SW846 1311	Solid/Haz. Waste	Inorganic Analysis
TCLP Volatile Organics	SW846 1311	Solid/Haz. Waste	Inorganic Analysis
Total Organic Carbon (TOC)	SW846 9060 A	Solid/Haz. Waste	Inorganic Analysis
Metals, Solids	SW846 3050B	Solid/Haz. Waste	Metals Prep
Mercury, Solid Waste	SW846 7471A/B	Solid/Haz. Waste	Metals Analysis
Metals by ICP	SW846 6010B/C	Solid/Haz. Waste	Metals Analysis

Method Capabilities by NELAP Accredited Fields of Testing

Analytes	Method Number	Program	Chemistry Field
Metals by ICP/MS	SW846 6020/6020A	Solid/Haz. Waste	Metals Analysis
Semivolatiles, Acid/Base Partition	SW846 3650B	Solid/Haz. Waste	Organics Prep
Semivolatiles, Alumina Cleanup	SW846 3610B	Solid/Haz. Waste	Organics Prep
Semivolatiles, Alumina Cleanup (Petro)	SW846 3611B	Solid/Haz. Waste	Organics Prep
Semivolatiles, Florisil Cleanup	SW846 3620B/C	Solid/Haz. Waste	Organics Prep
Semivolatiles, Gel Permeation Cleanup	SW846 3640A	Solid/Haz. Waste	Organics Prep
Semivolatiles, Silica Gel Cleanup	SW846 3630C	Solid/Haz. Waste	Organics Prep
Semivolatiles, Sulfur Cleanup	SW846 3660B	Solid/Haz. Waste	Organics Prep
Semivolatiles, Sulfuric Acid/MnO_2	SW846 3665A	Solid/Haz. Waste	Organics Prep
Semivolatile Prep, Waste Dilution	SW846 3580A	Solid/Haz. Waste	Organics Prep
Semivolatile Prep Solid, Sonication	SW846 3550B/C	Solid/Haz. Waste	Organics Prep
Semivolatile Prep Solids, Soxhlet	SW846 3540C	Solid/Haz. Waste	Organics Prep
Semivolatile Prep Water	SW846 3520C	Solid/Haz. Waste	Organics Prep
Semivolatile Prep Water	SW846 3510C	Solid/Haz. Waste	Organics Prep
Volatile, Headspace	SW846 3810	Solid/Haz. Waste	Organics Prep
Volatile, Purge & Trap, Solids–High	SW846 5035H/5035AH	Solid/Haz. Waste	Organics Prep
Volatile, Purge & Trap, Solids–Low	SW846 5035L/5035AL	Solid/Haz. Waste	Organics Prep
Volatile, Purge & Trap, Water	SW846 5030B	Solid/Haz. Waste	Organics Prep
Microwave Extraction	SW846 3546	Solid/Haz. Waste	Organics Prep
Alcohols	SW846 8015B	Solid/Haz. Waste	Organics Analysis
Base/Neutrals and Acids	SW846 8270C/D	Solid/Haz. Waste	Organics Analysis
Chlorinated Herbicides	SW846 8151A	Solid/Haz. Waste	Organics Analysis
DBCP, EDB & TCP	SW846 8011	Solid/Haz. Waste	Organics Analysis
Diesel Range Organic	SW846 8015B/C	Solid/Haz. Waste	Organics Analysis
Dissolved Gas/Aqueous Media	RSK-175	Solid/Haz. Waste	Organics Analysis
Ethylene Glycol & Propylene Glycol	SW846 8260B	Solid/Haz. Waste	Organics Analysis
Extractable Petroleum Hydrocarbons	NJDEP EPH	Solid/Haz. Waste	Organics Analysis
Gasoline Range Organic	SW846 8015B/C	Solid/Haz. Waste	Organics Analysis
Organochlorine Pesticides	SW846 8081A/B	Solid/Haz. Waste	Organics Analysis
PCBs	SW846 8082/A	Solid/Haz. Waste	Organics Analysis
Petroleum Hydrocarbons	NJ-OQA-QAM-25	Solid/Haz. Waste	Organics Analysis
Volatile Organics	SW846 8260B/C	Solid/Haz. Waste	Organics Analysis
Volatile Organics	EPA TO- 3	Clean Air Act	Organics Analysis
Volatile Organics	EPA TO-15	Clean Air Act	Organics Analysis

Method Capabilities—Non-NELAP Methods

Analytes	Method Number	Program	Chemistry Field
Phenols	EPA 420.4	Drinking Water	Inorganic Analysis
Carbon Dioxide	SM 4500-CO_2 C or D	Wastewater	Inorganic Analysis
Iodide	SM 4500-I B	Wastewater	Inorganic Analysis
Nonionic Surfactants as CTAS	SM 5540 D	Wastewater	Inorganic Analysis
Particulate Matter	EPA 160.2M	Wastewater	Inorganic Analysis
Petroleum Hydrocarbons	EPA 418.1	Wastewater	Inorganic Analysis
Phosphorus, Hydrolyzable	EPA 365.3	Wastewater	Inorganic Analysis
Redox Potential vs H^+	ASTM D1498-76	Wastewater	Inorganic Analysis
Specific Gravity	ASTM D1298-85	Wastewater	Inorganic Analysis
Total Organic Content	ASTM D2974-87	Wastewater	Inorganic Analysis
Unburned Combustibles	EPA 160.1+160.4	Wastewater	Inorganic Analysis
Viscosity	ASTM D445/6	Wastewater	Inorganic Analysis
Volatile Suspended Solids	EPA 160.2+160.4	Wastewater	Inorganic Analysis
Weak Acid Dissociable Cyanide Prep	SM 4500-CN I	Wastewater	Inorganic Analysis
Ammonia	EPA 350.1M	Solid/Haz. Waste	Inorganic Analysis
Ammonia	EPA 350.2M	Solid/Haz. Waste	Inorganic Analysis
Base Sediment	ASTM D473-81	Solid/Haz. Waste	Inorganic Analysis
Bulk Density (Dry Basis)	ASTM D2937-94M	Solid/Haz. Waste	Inorganic Analysis
Chemical Oxygen Demand	HACH 8000M	Solid/Haz. Waste	Inorganic Analysis
Chloride	EPA 325.3M	Solid/Haz. Waste	Inorganic Analysis
Combustion, Bomb Oxidation	SW846 5050	Solid/Haz. Waste	Inorganic Analysis
Grain Size & Sieve Testing	ASTM D422-63	Solid/Haz. Waste	Inorganic Analysis
Heat Content, BTU	ASTM D3286-85	Solid/Haz. Waste	Inorganic Analysis
Ignitability (Flashpoint)	ASTM D93-90/SW846 Ch 7	Solid/Haz. Waste	Inorganic Analysis
Multiple Extractions	SW846 1320	Solid/Haz. Waste	Inorganic Analysis
Neutral Leaching Procedure	ASTM D3987-85	Solid/Haz. Waste	Inorganic Analysis
Nitrate/Nitrite	EPA 353.2M	Solid/Haz. Waste	Inorganic Analysis
Organic Matter (Ignition Loss)	AASHTO T267-86M	Solid/Haz. Waste	Inorganic Analysis
Orthophosphate	EPA 365.2M	Solid/Haz. Waste	Inorganic Analysis
Percent Ash (Dry Basis)	ASTM D482-91	Solid/Haz. Waste	Inorganic Analysis
Percent Solids	ASTM D4643-00	Solid/Haz. Waste	Inorganic Analysis
Percent Sulfur	ASTM D129-61	Solid/Haz. Waste	Inorganic Analysis
Phosphorus, Total	EPA 365.3M	Solid/Haz. Waste	Inorganic Analysis
Phosphorus, Hydrolyzable	EPA 365.3M	Solid/Haz. Waste	Inorganic Analysis

Method Capabilities—Non-NELAP Methods

Analytes	Method Number	Program	Chemistry Field
Pour Point	ASTM D97-87	Solid/Haz. Waste	Inorganic Analysis
Reactive Cyanide	SW846 7.3.3.2	Solid/Haz. Waste	Inorganic Analysis
Reactive Sulfide	SW846 7.3.4.2	Solid/Haz. Waste	Inorganic Analysis
Redox Potential vs H^+	ASTM D1498-76M	Solid/Haz. Waste	Inorganic Analysis
Specific Gravity of Solids	ASTM D1429-86M	Solid/Haz. Waste	Inorganic Analysis
Sulfide (S)	EPA 376.1 M	Solid/Haz. Waste	Inorganic Analysis
Sulfite (SO_3)	EPA 377.1M	Solid/Haz. Waste	Inorganic Analysis
Total Chlorine	ASTM D808-91	Solid/Haz. Waste	Inorganic Analysis
Total Kjeldahl Nitrogen	EPA 351.2M	Solid/Haz. Waste	Inorganic Analysis
Total Organic Carbon	CORP ENG 81	Solid/Haz. Waste	Inorganic Analysis
Total Organic Carbon	LLOYD KAHN 1988	Solid/Haz. Waste	Inorganic Analysis
Total Organic Chlorine	ASTM D808-91M	Solid/Haz. Waste	Inorganic Analysis
Total Plate Count	SM 9215BM	Solid/Haz. Waste	Inorganic Analysis
Total Volatile Solids	EPA 160.4M	Solid/Haz. Waste	Inorganic Analysis
Water Content	ASTM D95-83	Solid/Haz. Waste	Inorganic Analysis
Diesel Range Organic	TCEQ 1005	Solid/Haz. Waste	Organics Analysis
Extractable Petroleum HCs	Massachusetts EPH	Solid/Haz. Waste	Organics Analysis
Extractable Petroleum HCs	Missouri DRO	Solid/Haz. Waste	Organics Analysis
Total Petroleum Hydrocarbons	FLDEP FL-PRO	Solid/Haz. Waste	Organics Analysis
Total Petroleum Hydrocarbons	Connecticut ETPH	Solid/Haz. Waste	Organics Analysis
Volatile Petroleum HCs	Massachusetts VPH	Solid/Haz. Waste	Organics Analysis
Volatile Petroleum HCs	Missouri GRO	Solid/Haz. Waste	Organics Analysis

Appendix IV

Laboratory Equipment

Equipment	Manufacture & Description	Serial Number	Operating System Software	Data Processing Software	Location	Purchase
GC-AA	GC Agilent 7890A/FID/Entech AutoAir7000	CN10361127	HP Chemstation	HP Enviroquant	Air Laboratory	N/A
GC-II	GC HP5890/ FID	320A40375	HP Chemstation	HP Enviroquant	Air Laboratory	N/A
GCMS- 5W	Agilent Technologies 5975C / 7890A / Entech7200pre-concentrator pre-concentrator	US13207902/CN13141001/1123	HP Chemstation	HP Chemstation	Air Laboratory	2013
GCMS-2W	Agilent Technologies 5975C / 7890A Entech 7016CA	CN10361158 / US10323601 / CN10361158	HP Chemstation	HP Enviroquant	Air Laboratory	2012
GCMS-3W	Agilent Technologies 5973 / 6890N Entech 7016A	CN10425086 / US41746669 / 1351	HP Chemstation	HP Enviroquant	Air Laboratory	2007
GCMS-Q	Hewlett-Packard 5890ll / 5971 MSD / Entech Air Samp 7000	3033A31092 / 3188A02934	HP Chemstation	HP Enviroquant	Air Laboratory	1993
GCMS-W	Agilent Technologies 5973 / 6890N AS Entech 7016CA	US44621451 / CN10517032 / 1119	HP Chemstation	HP Enviroquant	Air Laboratory	2005
GC-QT	Agilent 6890 / PID / FID / Entech 7032AB-L autosampler	US10148124/1176	HP Chemstation	HP Enviroquant	Air Laboratory	2010
GC-WW	Hewlett-Packard6890 / PID	US00010037	HP Chemstation	HP Enviroquant	Air Laboratory	2010
OVEN – 10A	Entech 3100A Canister cleaner	0404-4596	None	None	Air Laboratory	N/A
OVEN – 10C	Entech 3100A Canister cleaner	0404-4597	None	None	Air Laboratory	N/A
OVEN – 10E	Entech 3100A Canister cleaner	N/A	None	None	Air Laboratory	N/A
OVEN -10F	Entech 3100A Canister cleaner	N/A	None	None	Air Laboratory	N/A
Test Gauge	Ashcroft (TG-1)	None	None	None	Air Laboratory	N/A
Test Gauge	Ashcroft (TG-2)	None	None	None	Air Laboratory	N/A
Test Gauge	Ashcroft (TG-3)	None	None	None	Air Laboratory	N/A
Test Gauge	Ashcroft (TG-4)	None	None	None	Air Laboratory	N/A
DO Meter	YSI-51B	92A035818	None	None	Field Serv.	1998
DO Meter	YSI-55/12ft	00C0598BG	None	None	Field Serv.	2000

PH Meter-10	YSI	JC02538	None	None	Field Serv.	2007
PH Meter-11	YSI	JC02540	None	None	Field Serv.	2010
PH Meter-9	Orion 250A	O18019	None	None	Field Serv.	2007
SCON Meter	YSI-30	J0183	None	None	Field Serv.	2004
Balance- Top Load	Ohaus Adventure AV212 (B-36)	8029131104	None	None	IC Lab	2008
ASE	Dionex ASE 200	99030375	None	None	Inorganics	1999
Balance-Analytical	Ohaus Adventurer (B-24)	1225032523P	None	None	Inorganics	2004
Balance-Analytical	Mettler AE 160 (B-5)	C11620	None	None	Inorganics	1999
Balance- Top Load	Ohaus Adv. Pro (B43)	8032501223	None	None	Inorganics	2012
Balance- Top Load	Denver Inst. Co. XL500 (B-14)	B045530	None	None	Inorganics	Pre-2000
Balance- Top Load	Ohaus Adv. Pro (B52)	B334691952	None	None	Inorganics	2013
Balance- Top Load	Ohaus Explorer (B-16)	E1581119212171	None	None	Inorganics	2001
Balance- Top Load	Ohaus Adventurer (B-21)	E1021218270448	None	None	Inorganics	2001
Balance- Top Load	Ohaus Adventurer AV412 (B-27)	8026251106	None	None	Inorganics	2005
Balance- Top Load	Sartorius TE31025 (B-32)	21950273	None	None	Inorganics	2007
Balance- Top Load	Ohaus Adventure AV212 (B-35)	8029171184	None	None	Inorganics	2008
Balance- Top Load	Ohaus Adventurer-Pro (B-38)	8030441010	None	None	Inorganics	2009
Balance- Top Load	Denver P-214 (B-39)	25450279	None	None	Inorganics	2010
Balance- Top Load	A+D HR-250A (B53)	687601248	None	None	Inorganics	2012
Balance- Top Load	Ohaus Adv. Pro (B37)	8029161122	None	None	Inorganics	2013

Calorimeter	PARR 1261EA	1499	None	None	Inorganics	1996
COD Block	HACH DRB200	11020C0029	None	None	Inorganics	2010
Distillation Block 1	Lachat Micro Distillation system	A2000738	None	None	Inorganics	2010
Distillation Block 12	Lachat Micro Distillation system	A2000726	None	None	Inorganics	2010
Distillation Block 3	Lachat Micro Distillation system	A2000807	None	None	Inorganics	2010
DO Meter	YSI 5000	07B1560	None	None	Inorganics	2008
FIA Analyzer	Lachat Quikchem 8000	13200001620	None	None	Inorganics	
Flashpoint	Koehler – K16200	R07002295	None	None	Inorganics	2010
Flashpoint	Koehler – K16200	R07002563B	None	None	Inorganics	2010
Hg Analyzer	HYDRAA II	64013	Envoy	Envoy	Inorganics	2011
Hg Analyzer	Leeman Mercury Analyzer HYDRAAF Gold+	9003	WIN Hg Runner	WIN Hg Runner	Inorganics	2010
Hg Analyzer 7	Hydra II	64631	Envoy	Envoy	Inorganics	2013v
IC-2	Dionex ICS2000	2090737	Dionex Chrom. Client	Dionex Chrom. Client	Inorganics	2004
IC-3	Dionex ICS2000	2110028	Dionex Chrom. Client	Dionex Chrom. Client	Inorganics	2004
IC-4	Dionex ICS2000	4060060	Dionex Chrom. Client	Dionex Chrom. Client	Inorganics	2004
IC-6	Dionex ICS3000	6040160	Dionex Chrom. Client	Dionex Chrom. Client	Inorganics	2006
IC-9	Dionex IC5000+	13120208	Dionex Chrom. Client	Dionex Chrom. Client	Inorganics	2013
IR Spec.	Buck Scientific HC-404	687	None	None	Inorganics	1997
Oven (Inc-21)	Fisher	N/A	None	None	Inorganics	2014
Oven (Inc-7)	Precision	699030922	None	None	Inorganics	2014
Oven Inc 19	Total Dissolved Solids(180°C)	20-2100149111	None	None	Inorganics	2014
PH Meter-46	Thermo Orion 4 Star	B10299	None	None	Inorganics	2008

PH Meter-47	Thermo Orion 4 Star	B04869	None	None	Inorganics	2008
PH Meter-50	Orion Star Series	B27564	None	None	Inorganics	2010
PH Meter-51	Mettler	14011	None	None	Inorganics	2013
pH Meter-53	VWR Symphony B10P	1223350009	None	None	Inorganics	2013
PH Meter-54	Thermo Orion 710A	X08035	None	None	Inorganics	2013
PH Meter-55	Thermo-Orion	X10686	None	None	Inorganics	2014
pH Meter-57	VWR Symphony B10P	1411150002	None	None	Inorganics	2014
pH Meter-59	VWR Symphony B10P	14087S0006	None	None	Inorganics	2014
PH Meter-60	VWR Symphony B10P	1413950006	None	None	Inorganics	2014
PH-EH Meter-22	Thermo Orion 4 Star	SN00742	None	None	Inorganics	2008
SCON Meter	Amber Science 1056	01020851056-101	None	None	Inorganics	2001
SCON Meter	Orion 145+	78035	None	None	Inorganics	2004
Solvent Evaporator	Horizon SPE-DEX 3000XL	09-1031	None	None	Inorganics	2010
Solvent Evaporator	Horizon SPEED VAP III	09-0739	None	None	Inorganics	2010
TCLP Rotator 4	Assoc. Design and Mfg. Co. 3740-24-BRE-TM	N/A	None	None	Inorganics	2000
TCLP Rotator 5	Analytical Testing Corp. 42R5BCI-E3	0685KZJP0013	None	None	Inorganics	2002
TCLP Rotator 7&8	Assoc. Design and Mfg. Co. 3740-48BRE	N/A	None	None	Inorganics	2000
TCLP Rotator 9&10	Assoc. Design and Mfg. Co. 3740-48BRE	2132337	None	None	Inorganics	1996
TOC-L Analyzer	Shimadzu TOC-L	H52516900071	Shimadzu TOC Control	Shamadzu TOC Control	Inorganics	2012
TOC-L Analyzer	Shimadzu TOC-L	H52515000114NK	Shimadzu TOC Control	Shamadzu TOC Control	Inorganics	2013
TOC-V Analyzer	Shimadzu TOC-V CSH	H52504400192NK	Shimadzu TOC Control	Shimadzu TOC Control	Inorganics	2007
TOX Analyzer	Mitsubishi TOX-100	N/A	None	None	Inorganics	1996

TOX Analyzer	Mitsubishi TOX-100	A7M 42997	None	None	Inorganics	2008
UVVIS Spec E	Spectronix 20 Genesys	3SGD.352011	None	None	Inorganics	2007
UVVIS Spec J	Thermo Electron Corp. Genesys 20	3SGQ235018	None	None	Inorganics	20012
UVVIS Spec L	Thermo Electron Corp. Genesys 20	3SGS073003	None	None	Inorganics	2014
UVVIS Spec M	Spectronix 20 Genesys	3SG82480005	None	None	Inorganics	2013
UVVIS Spec N	Spectronix 20 Genesys	3SGS247010	None	None	Inorganics	2013
IC-8	Dionex IC5000	11030895	Dionex Chrom. Client	Dionex Chrom Client	Inorganics	
PH Meter-23	Thermo Orion Model 310	SN013786	None	None	Inorganics	2008
Hot Block 8	Environmental Express	N/A	None	None	Mercury Prep	
Hot Block 7	Environmental Express	N/A	None	None	Mercury Prep	
ICP	Thermo ICP 6500 Duo	ICP-20074909	ITEVA	ITEVA	Metals	2007
ICP	Thermo ICP 6500 Duo	ICP-20114506	ITEVA	ITEVA	Metals	2011
ICP	Thermo ICP 6500 Duo	ICP-20072601	ITEVA	ITEVA	Metals Analysis	2007
ICP	Thermo ICP 6500 Duo	IC5D20122506	ITEVA	ITEVA	Metals Analysis	2012
ICP	Thermo ICP 6500 Duo	IC76DC134708	ITEVA/QTEG RA	ITEVA/QTEGR A	Metals Analysis	2014
ICP-MS	Agilent 7700 Series	JP12412081	MassHunter Workstation	MassHunter Workstation	Metals Analysis	2014
ICP-MS	Agilent 7700 Series	JP10340551	MassHunter Workstation	MassHunter Workstation	Metals Analysis	2010
Balance- Top Load	Ohaus Adventurer AR3130 (B-26)	1240-P	None	None	Metals Prep	2004
Hot Block 1	Environmental Express	N/A	None	None	Metals Prep	
Hot Block 2	Environmental Express	N/A	None	None	Metals Prep	
Hot Block 3	Environmental Express	N/A	None	None	Metals Prep	
Hot Block 4	Environmental Express	N/A	None	None	Metals Prep	
Hot Block 5	Environmental Express	N/A	None	None	Metals Prep	
Hot Block 6	Environmental Express	N/A	None	None	Metals Prep	

Balance- Top Load	Ohaus Scout II (B-20)	BJ320905	None	None	Methanol Prep	2002
Balance- Top Load	Ohaus Scout II (B-25)	BJ514770	None	None	Methanol Prep	2004
Autoclave	Tuttnauer	1308435	None	None	Microbiology	2011
Incubator (BOD)	VWR	702499	None	None	Microbiology	2011
Incubator (Plates)	Theclo Precision	11T3	None	None	Microbiology	N/A
Incubator(BOD)	ISOTEMP	317646	None	None	Microbiology	2010
Incubator-Water Bath	INC-2	1200991	None	None	Microbiology	N/A
Refrigerator	R-44	0503MCBR980W0087	None	None	Microbiology	N/A
Incubator (Plates)	Thelco Precision	4-D-5	None	None	Microbiology	N/A
Balance- Top Load	Ohaus Adventurer Pro (B-46)	B304755401	None	None	Organic Prep	Pre-2000
Balance- Top Load	Ohaus Adventurer Pro (B-45)	B033051054	None	None	Organic Prep	2002
Balance- Top Load	Ohaus Adventurer Pro (B-42)	B031331113	None	None	Organic Prep	2007
Balance- Top Load	Ohaus Adventurer Pro (B-47)	4755411	None	None	Organic Prep	2013
Buchi -1	Buchi Concentrator System	1000175446	None	None	Organic Prep	2014
Buchi -2	Buchi Concentrator System	1000175108	None	None	Organic Prep	2014
Buchi-3	Buchi Concentrator System	1000175657	None	None	Organic Prep	2014
Buchi-4	Buchi Concentrator System	Not in service	None	None	Organic Prep	N/A
Centrifuge	Thermo Scientific	41394883	None	None	Organic Prep	2014
GPC4	Waters 717	717-000152	None	None	Organic Prep	1992
Microwave-3	MARS 6 CEM	MJ2659 (warranty expires June 2014)	None	None	Organic Prep	2013
Microwave-4	MARS 6 CEM	MJ2198	None	None	Organic Prep	2013
Microwave-5	MARS 6 CEM	MJ2197	None	None	Organic Prep	2013
Mini Water Bath	Thermo Scientific	234221-1379	None	None	Organic prep	2014
N-EVAP 1	Organomation	59301	None	None	Organic Prep	2014
N-EVAP 2	Organomation	58202	None	None	Organic Prep	2014

Sonicator	Fisher	F550	None	None	Organic Prep	N/A
Sonicator	Bransen	BIO3037527	None	None	Organic Prep	N/A
Sonicator	Misonix	S3000	None	None	Organic Prep	1997
Water Bath 1	Organomation	13385	None	None	Organic Prep	2010
Water Bath 10	Organomation	58394	None	None	Organic prep	2014
Water Bath 11	Organomation	58384	None	None	Organic prep	2014
Water Bath 2	Thermo Scientific	176676-1289	None	None	Organic Prep	2014
Water Bath 3	Organomation	58471	None	None	Organic Prep	2010
Water Bath 4	Organomation	58421	None	None	Organic Prep	2014
Water Bath 5	Organomation	58422	None	None	Organic Prep	2014
Water Bath 8	Organomation	58424	None	None	Organic Prep	2014
Water Bath 9	Organomation	58425	None	None	Organic prep	2013
Water Bath 6	Organomation	58423	None	None	Organic Prep	2014
Water Bath 7	Organomation	58379	None	None	Organic Prep	2014
GC-SN	Hewlett Packard 5890 GC/5970 MSD/OI 4551/4560	2623A08318/2637A01687/D538475262/1542 461919	HP Chemstation	Hp Enviroquant	Organics,	Re-Built 2012
GC-SC	Hewlett-Packard 5890 / FID / OI4551 / 4560	2443AO3797	HP Chemstation	HP Enviroquant	Organics; Screening	1990
GC-SR	Hewlett-Packard 5890 / FID / Tekmar 7000	2612A07448	HP Chemstation	HP Enviroquant	Organics; Screening	1992
GC-ST	Hewlett-Packard 5890 / FID / NPD / HP 7673 AS / Tek	314OA38871	HP Chemstation	HP Enviroquant	Organics; Screening	1996
GC-SV	Hewlett-Packard 5890 / FID / OI4551 / 4560	LR47-359C / N244460743 / 3336A58859	HP Chemstation	HP Enviroquant	Organics; Screening	1996
GC 7y/7z	Agilent Technologies 6890N / 7683	US00043006 / US12211759 / CN52926441 / CN60931595	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GC-5G	Agilent Technologies 7890N/7693	CN12131022 / CN12060027 / CN12070097 / U20782/U20781	HP Chemstation	HP Enviroquant	Organics; SVOCs	2008
GC-5y-5z	Agilent Technologies 7890N / 7683	CN11461115 / CN11380009 / CN11390012 / CN73342671	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GC-6G	Agilent Technologies 6890N 7683	CN10611064 / CN44330971 / CN40334835 / U4788 / U18013	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GC-6y-6z	Agilent Technologies 7890N / 7683	CN11461118 / CN10310044 / CN83252932 / CN73342695	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010

GC-7G	Agilent Technologies 6890N 7683	US10606009 / CN53236207 / CN40434847 / U23574/ U24374	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GC-8y/8z	Agilent Technologies 6890N / 7683	US10240121 / GT030513A / CN43038210 / CN40334821	HP Chemstation	HP Enviroquant	Organics; SVOCs	2011
GCMS-4P	Agilent Technologies 5973 / 6890N AS 7683 AS	CN10251017 / US102440773 / CN34727122 / CN61031719	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GCMS-5P	Agilent Technologies 5973 / 6890N AS 7683 AS	CN10222060 / US21844818 / CN52834726 / CN21725012	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GC-XX	Hewlett-Packard 6890 / Dual ECD / HP 7683 AS	US00022968 / CN32023953 / CN32030876 / U0109 / U0905	HP Chemstation	HP Enviroquant	Organics; SVOCs	1998
GC-UV	Hewlett-Packard 5890 / Dual FID / OI 4551 / 4560	2921A23322	HP Chemstation	HP Enviroquant	Organics; Volatiles	1996
GC-2Y/2Z	Agilent Technologies 6890N 7683	CN10407032 / CN61633946 / US94209706 / US01112207	HP Chemstation	HP Enviroquant	Organics; SVOCs	2004
GC-OA	Agilent Technologies 6890N / 7683	US10240147 / CN23021337 / CN320308791 / U5591 / U7670	HP Chemstation	HP Enviroquant	Organics; SVOCs	2002
GC-YZ/ZZ	Hewlett-Packard 6890 / 6890	US00011065 / 3527A39121 / 3521A42714 / 3511A42110	HP Chemstation	HP Enviroquant	Organics; SVOCs	2008
GC-EF	Hewlett-Packard 5890 / Dual ECD / HP 7673 AS	2541A06786 / 2942A20889 /F1916 / F5562	HP Chemstation	HP Enviroquant	Organics; Volatiles	1992
GC-LM	Hewlett-Packard 6890 / PID / FID / OI 4551 / 4560 P&T	US00008927	HP Chemstation	HP Enviroquant	Organics; Volatiles	1998
GCMS-L	Hewlett-Packard 5890 / 5970 MSD / OI 4551 / 4560 P&T	2921A22898 / 2623A01291	HP Chemstation	HP Enviroquant	Organics; Volatiles	1992
GC-SY	Hewlett-Packard 5890 / FID / OI4551A / 4560	2643A10503	HP Chemstation	HP Enviroquant	Organics; Screening	1990
GC-1G	Agilent Technologies 6890N / 7683	US10322012 / CN23821917 / CN23326744 / U21778 / U5597	HP Chemstation	HP Enviroquant	Organics; SVOCs	2003
GC-2G	Agilent Technologies 6890N / 7683	CN10450110 / CN24922557 / CN45022276 / U17684 / U7668	HP Chemstation	HP Enviroquant	Organics; SVOCs	2005
GC-3G	Agilent Technologies 6890N / 7683	CN10450109 / CN24922566 / CN45022167 / U7666 / U7667	HP Chemstation	HP Enviroquant	Organics; SVOCs	2005
GC-3Y/3Z	Agilent Technologies 7890A / 7683B	CN10735014 / CN74345941 / CN83252932 / CN73342695	HP Chemstation	HP Enviroquant	Organics; SVOCs	2007
GC-4G	Agilent Technologies 6890N / 7693	CN10361136 / CN10340093 / CN10310033 / U17615 / U17614	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GC-4Y/4Z	Agilent Technologies 7890A / 7693B	CN10832133 / CN84451068 / CN83252936 / CN73342671	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GCMS-2M	Agilent Technologies 5975 / 6890N AS 7683	CN10612028 / US60532578 / CN4593809290 / US82601187	HP Chemstation	HP Enviroquant	Organics; SVOCs	2012

GCMS-2P	Agilent Technologies 5975C / 7890A / 7693	US10237403 / CN10241022 / CN10210021 / CN10180007	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GCMS-3E	Agilent Technologies 5975 / 6890N / 7683	CN10614011 / US61332852 / CN23326747 / US93901916	HP Chemstation	HP Enviroquant	Organics; SVOCs	2011
GCMS-3M	Agilent Technologies 5975B / 6890N / Agilent 7683B	US65125107 / CN10703029 / CN73943902 / US83801832	HP Chemstation	HP Enviroquant	Organics; SVOCs	2007
GCMS-3P	Agilent Technologies 5975C / 7890A / 7693	CN10361100 / CN10361163 /	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GCMS-4M	Agilent Technologies 5975C / 7890A / 7683B	US73317574 / CN1074251 / CN74043923 / CN74145736	HP Chemstation	HP Enviroquant	Organics; SVOCs	2007
GCMS-4P	Agilent Technologies 5973 / 6890N AS 7683 AS	CN10251017 / US102440773 / CN34727122 / CN61031719	HP Chemstation	HP Enviroquant	Organics; SVOCs	2011
GCMS-6P	Agilent Technologies 5973 / 6890N AS 7683 AS	CN10536029 / US52420712 / US10310521 / CN55230259	HP Chemstation	HP Enviroquant	Organics; SVOCs	2011
GCMS-F	Agilent 6890 / 5973 MSD / 7683 AS	US00034179 / US01140200 / CN40327643 / CN138822139	HP Chemstation	HP Enviroquant	Organics; SVOCs	1998
GCMS-H	Hewlett-Packard 5890ll+ / 5972 MSD / HP 7673 AS	3336A58190 / 3501A02356 / 3123A25133	HP Chemstation	HP Enviroquant	Organics; SVOCs	1995
GCMS-M	Hewlett-Packard 6890 / 5973 MSD / HP 7683 AS	US00021813 / US802111003 / US81501001 / CN61038860	HP Chemstation	HP Enviroquant	Organics; SVOCs	1999
GCMS-P	Agilent Technologies 5973 / 6890N AS 7683 AS	US10251064 / US21844598 / CN74145733 / CN24828486	HP Chemstation	HP Enviroquant	Organics; SVOCs	2003
GCMS-R	Agilent Technologies 6890 / 5973 MSD / 7683	US00021820 / US81211033 / US84202752 / CN61639349	HP Chemstation	HP Enviroquant	Organics; SVOCs	2008
GCMS-Z	Agilent Technologies 5973 / 6890N AS 7683 AS	US10251028 / US21844586 / CN24828485 / CN23321564	HP Chemstation	HP Enviroquant	Organics; SVOCs	2003
Balance- Top Load	Ohaus Sport (B-28)	7124230518	None	None	Organics; Volatiles	2005
Balance- Top Load	Ohaus Adventure AV412 (B-34)	8028391117	None	None	Organics; Volatiles	2007
GC-AA	Agilent 7890A / AS 7683B	CN10832133 / US08232002	HP Chemstation	HP Enviroquant	Organics; Volatiles	2008
GC-GH	Hewlett-Packard 5890	2938A25059	HP Chemstation	HP Enviroquant	Organics; Volatiles	1990
GCMS-1A	Agilent Technologies 5973 / 6890N AS 4551A / 4660	CN10314026 / US30945331	HP Chemstation	HP Enviroquant	Organics; Volatiles	2003
GCMS-1B	Agilent Technologies 7890A / 5975C /Teledyne / Tekmar AquaTek AS	CN10845177 / US83111119	HP Chemstation	HP Enviroquant	Organics; Volatiles	2008
GCMS-1C	Agilent Technologies 5973 /	CN10425085 / US41746667	HP Chemstation	HP Enviroquant	Organics;	2004

	6890N AS 4551 / 4560				Volatiles	
GCMS-2A	Agilent Technologies 5973 / 6890N AS Tekmar Solatek 72	CN10314028 / US30945325	HP Chemstation	HP Enviroquant	Organics; Volatiles	2003
GCMS-2B	Agilent Technologies 5973 / 6890N AS 4551A / 4660	CN10441033 / US 43146954	HP Chemstation	HP Enviroquant	Organics; Volatiles	2004
GCMS-2C	Agilent Technologies 5973 / 6890N AS 4551A / 4560	CN10441035 / US 43146953	HP Chemstation	HP Enviroquant	Organics; Volatiles	2004
GCMS-2D	Agilent Technologies 5973 / 6890N AS 4552 / 4560	CN10432038 / US43146771	HP Chemstation	HP Enviroquant	Organics; Volatiles	2004
GCMS-2E	Agilent Technologies 5975 / 6890N AS 4551A / 4660	CN10612046 / US60532596	HP Chemstation	HP Enviroquant	Organics; Volatiles	2006
GCMS-3A	Agilent Technologies 5973 / 6890N AS 4551A / 4660	CN10432042 / US43146776	HP Chemstation	HP Enviroquant	Organics; Volatiles	2004
GCMS-3B	Agilent Technologies 6890 / 5973 / OI 4551A / 4660	US10240044 / US21844015	HP Chemstation	HP Enviroquant	Organics; Volatiles	2002
GCMS-3C	Agilent Technologies 5973 / 6890N AS 45551A / 4660	CN10517038 / US44621480	HP Chemstation	HP Enviroquant	Organics; Volatiles	2005
GCMS-3D	Agilent Technologies 5975B / 6890N AS 4551A / 4660	CN10637120 / US62724193	HP Chemstation	HP Enviroquant	Organics; Volatiles	2006
GCMS-3V	Agilent Technologies 5975C/7890A/OI 4552/ 4560	US1321790 / CN13141045	HP Chemstation	HP Enviroquant	Organics; Volatiles	2013
GCMS-4B	Agilent Technologies 5975C / 7890A	US10323601 / CN10361158	HP Chemstation	HP Enviroquant	Organics; Volatiles	2010
GCMS-4D	Agilent Technologies 5975C / 7890A	US10237301 / CN10241019	HP Chemstation	HP Enviroquant	Organics; Volatiles	2010
GCMS-4V	Agilent Technologies 5975C/7890A/OI 4100/ 4660	Us13307901 / CN13331029	HP Chemstation	HP Enviroquant	Organics; Volatiles	2013
GCMS-A	Hewlett-Packard 6890 / 5973 MSD / OI 4552 / 4560 ARCHON	US00033272 / US94212183	HP Chemstation	HP Enviroquant	Organics; Volatiles	2000
GCMS-C	Hewlett-Packard 6890 / 5973 MSD / OI 4552 / 4560 ARCHON	2643A122671 / 2807A1146	HP Chemstation	HP Enviroquant	Organics; Volatiles	1990
GCMS-D	Hewlett-Packard 6890 / 5973 MSD / OI 4551 / 4560 ARCHON	US00030551 / US93122843	HP Chemstation	HP Enviroquant	Organics; Volatiles	2001
GCMS-E	Hewlett-Packard 6890 / 5973 MSD / OI 4551 / 4560 ARCHON	US00031161 / US93112044	HP Chemstation	HP Enviroquant	Organics; Volatiles	2001

GCMS-G	Hewlett-Packard 5890ll / 5970 MSD / OI 4552 / 4660	2919A22540 / 2807A11004	HP Chemstation	HP Enviroquant	Organics; Volatiles	1989
GCMS-I	Hewlett-Packard 5890 / 5970 MSD / OI 4551 / 4560	2623A08318 / 2637A01687	HP Chemstation	HP Enviroquant	Organics; Volatiles	1986
GCMS-J	Hewlett-Packard 5890 / 5970 MSD / OI 4552 / 4560 P&T	2643A11557 / 3034A12779	HP Chemstation	HP Enviroquant	Organics; Volatiles	1990
GCMS-K	Hewlett-Packard 5890l1 / 5970 MSD / OI 4551 / 4560 P&T	2750A116838 / 2905A11628	HP Chemstation	HP Enviroquant	Organics; Volatiles	1990
GCMS-N	Hewlett-Packard 5890 / 5970 MSD / Tekmar 2000 / 2032 P&T	2750A17088 / 2716A10218	HP Chemstation	HP Enviroquant	Organics; Volatiles	1988
GCMS-S	Hewlett-Packard 6890 / 5973 MSD /OI 4552 / 4660 ARCHON	US00024322 / US82311313	HP Chemstation	HP Enviroquant	Organics; Volatiles	2000
GCMS-T	Hewlett-Packard 6890 / 5973 MSD / OI 4551A / 4660 P&T	US00024323 / US82311482	HP Chemstation	HP Enviroquant	Organics; Volatiles	2000
GCMS-U	Hewlett-Packard 6890 / 5973 MSD / HP 4551A / 4660	US00032623 / US94212203	HP Chemstation	HP Enviroquant	Organics; Volatiles	1999
GCMS-V	Agilent Technologies 5973 / 6890N AS 4552 / 4560	US10149085 / US10441917	HP Chemstation	HP Enviroquant	Organics; Volatiles	2002
GCMS-X	Agilent Technologies 5973 / 6890N AS 4552 / 4660	US21843889 / US10239071	HP Chemstation	HP Enviroquant	Organics; Volatiles	2002
GCMS-Y	Agilent Technologies 5973 / 6890N AS 4552 / 4560	US10240013 / US21844012	HP Chemstation	HP Enviroquant	Organics; Volatiles	2002
GC-PF	Agilent Technologies 6890N AS 4552 / 4560	US10235024 / 12995 / J542460192	HP Chemstation	HP Enviroquant	Organics; Volatiles	2002
PH Meter-13	VWR IS B20	5942	None	None	Sample Management	2010
Balance- Top Load	Ohaus Adventure AV412 (B-33)	8028391184	None	None	Sample Management	2007
Balance- Top Load	Ohaus Adventurer AV412 (B-30)	8026391160	None	None	Screen	2005